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TRANSACTIONS

OF THE

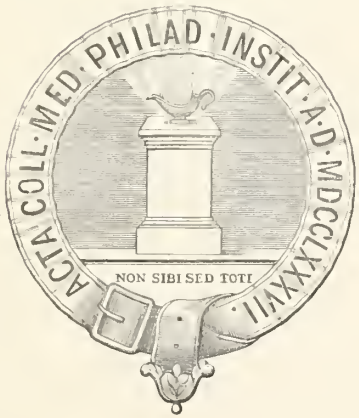
COLLEGE OF PHYSICIANS

OF

PHILADELPHIA.

THIRD SERIES.

VOLUME THE TWENTY-FOURTH.



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1902.

NOTICE.

The present volume of TRANSACTIONS contains the papers read before the College from January, 1902, to December, 1902, inclusive.

The Committee of Publication thinks it proper to say that the College holds itself in no way responsible for the statements, reasonings, or opinions set forth in the various papers published in its TRANSACTIONS.

EDITED BY

WILLIAM ZENTMAYER.

DORNAN, PRINTER

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1902.

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Clerk, Francis R. Packard, M.D.

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Clerk, John H. Girvin, M.D.

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Clerk, S. McC. Hamill, M.D.

* Died November 1, 1902.

LIST

OF THE

PRESIDENTS OF THE COLLEGE FROM THE TIME OF ITS INSTITUTION.

ELECTED

1787 JOHN REDMAN

1805 WILLIAM SHIPPEN

1809 ADAM KUHN

1818 THOMAS PARKE

1835 THOMAS C. JAMES*

1835 THOMAS T. HEWSON

1848 GEORGE B. WOOD

1879 W. S. W. RUSCHENBERGER

1883 ALFRED STILLÉ

1884 SAMUEL LEWIS†

1884 J. M. DA COSTA

1886 S. WEIR MITCHELL

1889 D. HAYES AGNEW

1892 S. WEIR MITCHELL

1895 J. M. DA COSTA

1898 JOHN ASHHURST, JR.

1900 W. W. KEEN

1902 HORATIO C. WOOD

* Died four months after his election.
† Resigned on account of ill-health.

FELLOWS

OF THE

COLLEGE OF PHYSICIANS OF PHILADELPHIA.

DECEMBER, 1902.

* Non-resident Fellows.
† Fellows who have commuted dues.

ELECTED

*1883. Abbot, Griffith E., Ph.D., M.D., Washington, D.C.

1892. Abbott, Alex. C., M.D., Professor of Hygiene and Bacteriology, and Director of the Laboratory of Hygiene in the University of Pennsylvania.

1876. Alison, Robert H., M.D., Attending Physician to the Bryn Mawr Hospital.

1873. Allis, Oscar H., M.D., Surgeon to the Presbyterian Hospital.

1896. Allyn, Herman B., M.D., Instructor in Physical Diagnosis in the University of Pennsylvania; Physician to the Philadelphia Hospital; Clinical Professor of Medicine in the Woman's Medical College of Pennsylvania.

1888. Anders, James M., M.D., LL.D., Professor of the Theory and Practice of Medicine and Clinical Medicine in the Medico-Chirurgical College; Physician to the Medico-Chirurgical and Samaritan Hospitals.

1869. Andrews, T. Hollingsworth, M.D.

1896. Angney, William M., M.D., Physician to the House of Mercy (Home for Male Consumptives); Consulting Physician to the Hospital for Diseases of the Lungs, at Chestnut Hill.

*1882. Ashbridge, Richard, M.D., West Whiteland, Pa.

1893. Ashton, Thomas G., M.D., Physician to the Philadelphia Hospital; Assistant Physician to the Jefferson Medical College Hospital; Clinical Professor of Medicine in the Woman's Medical College of Pennsylvania.

ELECTED

1857. Atlee, Walter Franklin, A.M., M.D., Corresponding Member of La Société des Sciences Médicales de Lyons; Consulting Surgeon to St. Luke's Hospital, Bethlehem; Visiting Physician to the Preston Retreat.

1852. Bache, Thomas Hewson, M.D.

1883. Baer, Benjamin F., M.D., Professor of Gynecology in the Philadelphia Polyclinic.

†1892. Baker, George Fales, B.S., M.D.

1879. Baker, Washington H., M.D., Obstetrician to the Maternity Hospital.

1889. Baldy, John Montgomery, M.D., Professor of Gynecology in the Philadelphia Polyclinic; Surgeon to the Gynecean Hospital and to the Gynecological Out-patient Department of the Pennsylvania Hospital; Consulting Surgeon to the Frederick Douglass Memorial Hospital.

1898. Balliet, Tilghman M., A.M., M.D., Professor of Therapeutics at Dartmouth College, Hanover, N. H.; Physician to the Old Man's Home.

1880. Bartholow, Roberts, M.D., Professor (Emeritus) of Materia Medica, General Therapeutics and Hygiene in the Jefferson Medical College.

1894. Barton, James M., M.D., Surgeon to the Jefferson Medical College Hospital and to the Philadelphia Hospital.

1883. Baum, Charles, A.M., M.D., Ph.D.

1883. Beates, Henry, M.D.

1860. Benner, Henry D., M.D.

1874. Bennett, W. H., M.D., Physician-in-Charge to the Seashore Home for Invalid Children, and to the Seaside House for Invalid Women, Atlantic City; formerly Physician to the Episcopal Hospital, and Physician-in-Charge to St. Christopher's Hospital for Children.

1896. Beyea, Henry D., M.D., Instructor in Gynecology and Assistant Demonstrator of Obstetrics in the University of Pennsylvania; Assistant Surgeon to the Gynecean Hospital.

†1884. Biddle, Alexander W., M.D.

1884. Biddle, Thomas, M.D.

*1866. Black, J. J., M.D., New Castle, Del.

ELECTED

1894. Bliss, Arthur Ames, M.D., Laryngologist and Aurist to the German Hospital; Consulting Laryngologist to the Pennsylvania Institution for the Deaf and Dumb.

*1867. Boardman, Charles H., M. D.

1894. Bochroch, Max H., M.D., Demonstrator of Neurology, and Chief Clinical Assistant in the Nervous Department of the Jefferson Medical College Hospital; Neurologist to the Outpatient Department of St. Joseph's Hospital.

1896. Boger, John A., M.D., Surgeon to St. Mary's and the Samaritan Hospitals; Surgeon to the Dispensary of the Episcopal Hospital.

1891. Boyd, George M., M.D., Clinical Professor of Obstetrics in the Medico-Chirurgical College; Physician to the Philadelphia Lying-in Charity Hospital and Nurse School.

†1884. Bradford, T. Hewson, M.D.

1856. Brinton, John H., M.D., LL.D., Professor of the Practice of Surgery and of Clinical Surgery in the Jefferson Medical College; Consulting Surgeon to St. Joseph's Hospital and to the Southwestern Hospital of Philadelphia.

1891. Brinton, Lewis, M.D., Visiting Physician to the Nervous Department of the Howard Hospital.

1900. Brinton, Ward, M.D., Demonstrator of Physical Diagnosis in the Jefferson Medical College; Physician to the Dispensary of St. Christopher's Hospital for Children; Assistant in the Medical Dispensary of the Jefferson Medical College Hospital.

1887. Brubaker, Albert P., M.D., Professor of Physiology in the Pennsylvania College of Dental Surgery; Adjunct Professor of Physiology and Hygiene in the Jefferson Medical College; Lecturer on Anatomy and Physiology in the Drexel Institute.

*1890. Brush, Edward N., M.D., Medical Superintendent of the Shepherd and Enoch Pratt Hospital, Towson, Md.

*1851. Bullock, William R., M.D., Wilmington, Del.

1892. Burr, Charles W., M.D., Professor of Mental Diseases in the University of Pennsylvania; Neurologist to the Philadelphia Hospital.

1886. Cadwalader, Charles E., M.D.

1895. Carpenter, John T., M.D., Instructor in Ophthalmology in the University of Pennsylvania.

ELECTED

*1897. Carter, William S., M.D., Professor of Physiology in the University of Texas.

1892. Cattell, Henry W., A.M., M.D., Editor of the *International Clinics*.

*1892. Cerna, David, M.D., Ph.D., Galveston, Texas, Demonstrator of Physiology in the Department of Medicine of the University of Texas; Corresponding Fellow of the Sociedad Española de Higiene of Madrid.

1900. Chance, Burton Kollock, M.D., Assistant Surgeon to the Wills Eye Hospital.

1885. Chapin, John B., M.D., Physician-in-Chief to the Pennsylvania Hospital for the Insane.

1880. Chapman, Henry C., M.D., Professor of the Institutes of Medicine and of Medical Jurisprudence in the Jefferson Medical College.

1900. Chase, Robert Howland, A.M., M.D., Superintendent of the Friends' Asylum for the Insane.

1868. Cheston, D. Murray, M.D.

1897. Cheston, Radcliffe, M.D.

1899. Clark, John G., M.D., Professor of Gynecology in the University of Pennsylvania; Gynecologist-in-Chief to the University Hospital.

1897. Claxton, Charles, A.M., M.D.

1872. Cleemann, Richard A., M.D.

1896. Cleveland, Arthur H., M.D., Clinical Professor of Laryngology in the Medico-Chirurgical College; Laryngologist to the Medico-Chirurgical Hospital; Laryngologist and Aurist to the Presbyterian Hospital, and to the Pennsylvania Institution for the Deaf and Dumb.

1871. Cohen, J. Solis, M.D., Professor (Honorary) of Laryngology in the Jefferson Medical College; Professor (Emeritus) of Diseases of the Throat in the Philadelphia Polyclinic; Consulting Physician to the Protestant Episcopal Mission; Physician to the Hospital for Diseases of the Lungs, Chestnut Hill.

1888. Cohen, Solomon Solis, M.D., Senior Assistant Professor of Clinical Medicine in the Jefferson Medical College; Physician to the Jefferson Medical College Hospital, to the Philadelphia Hospital, to the Jewish Hospital, and to the Rush Hospital.

ELECTED

1898. Coles, Stricker, M.D., Demonstrator and Clinical Lecturer on Obstetrics in the Jefferson Medical College; Assistant Obstetrician to the Jefferson Maternity.

1901. Coley, Thomas Luther, M.D., Assistant Physician to the Methodist Episcopal Hospital; Associate Editor of the *Therapeutic Monthly;* Assistant Editor of the *Philadelphia Medical Journal.*

1895. Cross, William A., M.D., Consulting Physician to the Jewish Hospital.

1902. Currie, Charles A., M.D., Physician to the Germantown Hospital.

1884. Curtin, Roland Gideon, A.M., M.D., Ph.D., Physician to the Philadelphia and the Presbyterian Hospitals; Consulting Physician to St. Timothy's Hospital and the Rush Hospital for Consumptives.

1884. Da Costa, John C., M.D., Gynecologist to the Jefferson Medical College Hospital; Consulting Gynecologist to St. Agnes's Hospital; President of the Philadelphia Obstetrical Society.

1896. Da Costa, John Chalmers, M.D., Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College; Surgeon to Philadelphia and St. Joseph's Hospitals.

1887. Daland, Judson, M.D., Instructor in Clinical Medicine in the University of Pennsylvania; Assistant Physician to the Hospital of the University of Pennsylvania; Professor of Clinical Medicine in the Philadelphia Polyclinic; Consulting Physician to the Kensington Hospital for Women.

1859. Darrach, James, M.D., Consulting Surgeon to the Germantown Hospital.

1896. Davis Charles N., M.D., Assistant Physician to the Dispensary for Diseases of the Skin in the Hospital of the University of Pennsylvania; Consulting Dermatologist to St. Mary's Hospital; Associate Physician in the Dispensary for Skin Diseases in the Howard Hospital; Associate Physician for Skin Diseases in the Northern Dispensary.

1888. Davis, Edward P., A.M., M.D., Professor of Obstetrics in the Jefferson Medical College and in the Philadelphia Polyclinic; Visiting Obstetrician to the Jefferson and Polyclinic Hospitals; Obstetrician and Gynecologist to the Philadelphia

ELECTED

Hospital; Member of the American Gynecological Society, the American Pediatric Society, and of the International Congress of Obstetrics and Gynecology.

1889. Davis, Gwilym G., M.D. (Univ. of Penna. and Goettingen), M.R.C.S. Eng., Assistant Professor of Applied Anatomy in the University of Pennsylvania; Surgeon to the Episcopal, St. Joseph's, and Orthopædic Hospitals.

1900. Davisson, Alex. Heron, M.D.

1894. Deaver, Harry C., M.D., Surgeon to the Episcopal, St. Mary's, and Samaritan Hospitals, and to St. Christopher's Hospital for Children.

1887. Deaver, John B., M.D., Surgeon-in-Chief to the German Hospital; Consulting Surgeon to the Germantown Hospital.

1892. Deaver, Richard Wilmot, M.D.

1902. Dehoney, Howard, M.D.

1885. Dercum, Francis X., M.D., Clinical Professor of Neurology in the Jefferson Medical College; Neurologist to the Philadelphia Hospital; Consulting Neurologist to St. Agnes's and the Jewish Hospitals, and to the State Asylum for the Chronic Insane of Pennsylvania.

1891. Dixon, Samuel G., M.D., President and Executive Curator of the Academy of Natural Sciences of Philadelphia; Member of the Council of the American Philosophical Society; Member of the Board of Trustees of the Wistar Institute of Anatomy; Member of the Board of Managers of the Philadelphia Zoölogical Society.

1896. Donnellan, P. S., M.D., L.R.C.S. and P., Ireland; Laryngologist to St. Agnes's Hospital; Medical Examiner of the Mutual Life Insurance Company of New York.

1897. Dorland, W. A. Newman, M.D., Associate in Gynecology in the Philadelphia Polyclinic and College for Graduates in Medicine; Assistant Demonstrator of Obstetrics in the University of Pennsylvania; Vice-President American Academy of Medicine (1901).

1902. Dougherty, Sherborne W., M.D., Instructor in Physical Diagnosis in the University of Pennsylvania; Physician to the Dispensary of the German Hospital; Assistant Physician to the Methodist Hospital.

ELECTED

1893. Downs, Norton, M.D.

1864. Downs, R. N., M.D.

1902. Downs, Robert N., Jr., M.D., Surgeon to the Dispensary of the Germantown Hospital.

1884. Drysdale, T. M., M.D.

1864. Duer, Edward L., A.M., M.D., Gynecologist to the Presbyterian Hospital; Consulting Obstetrician to the Maternity Hospital and to the Preston Retreat.

1897. Duer, S. Naudain, M.D., Physician to the Dispensary of the Presbyterian Hospital.

1871. Duhring, L. A., M.D., Professor of Skin Diseases in the University of Pennsylvania.

1881. Dulles, Charles Winslow, M.D., Lecturer on the History of Medicine in the University of Pennsylvania; Surgeon to the Rush Hospital.

*1871. Dunglison, Thomas R., M.D., Rosny sous Bois (Seine), France.

1860. Dunton, William R., M.D., Consulting Physician to the Germantown Hospital.

1899. Edsall, David L., M.D., Instructor in Clinical Medicine in the University of Pennsylvania; Assistant Physician to the University Hospital; Associate of the Pepper Laboratory of Clinical Medicine; Physician to the Home for Incurables and to St. Christopher's Hospital for Children; Pathologist to the Methodist Hospital.

*1887. Edwards, William A., M.D., Physician to the Coronado Hospital, Coronado, California.

1896. Ely, Thomas C., A.M., M.D.

1901. Erck, Theodore A., M.D., Assistant Surgeon to the Gynecean Hospital; Associate in Gynecology in the Philadelphia Polyclinic and College for Graduates in Medicine; Gynecologist to the Frederick Douglass Memorial Hospital.

1893. Eshner, Augustus A., M.D., Professor of Clinical Medicine in the Philadelphia Polyclinic and College for Graduates in Medicine; Physician to the Philadelphia Hospital; Assistant Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Physician to the Hospital for Diseases of the Lungs, at Chestnut Hill.

1868. Evans, Horace Y., A.M., M.D.

ELECTED

1894. Faries, Randolph, M.D., Surgeon to the Orthopædic Dispensary of the Hospital of the University of Pennsylvania; Director of Physical Education in the Protestant Episcopal Academy.

1893. Farr, William W., M.D.

1884. Fenton, Thomas H., M.D., Medical Director and Senior Ophthalmologist to the Union Mission Hospital; Ophthalmologist to St. Vincent's Home, to the Home for Aged Couples, to the Baptist Home, and to the House of the Good Shepherd.

1884. Fisher, Henry M., M.D., Physician to the Episcopal Hospital; Physician to the Out-patient Department of the Pennsylvania Hospital.

1900. Flexner, Simon, M.D., Professor of Pathology in the University of Pennsylvania; Pathologist to the Philadelphia Hospital; Member of the Association of American Physicians; Corresponding Member of La Societa Medico-Chirurgica di Bologna.

1888. Flick, Lawrence F., M.D.

1862. Forbes, William S., M.D., Professor of Anatomy in the Jefferson Medical College; Clinical Surgeon to the Jefferson Medical College Hospital.

†1885. Fox, Joseph M., M.D., Leesburg, Va.

1897. Frazier, Charles H., M.D., Professor of Clinical Surgery in the University of Pennsylvania; Surgeon to the University, Philadelphia, and Howard Hospitals; Surgeon to the Home for Crippled Children.

†1890. Freeman, Walter J., M.D., Professor of Laryngology in the Philadelphia Polyclinic; Laryngologist to the Children's and Orthopædic Hospitals; Consulting Laryngologist to the Pennsylvania Institution for the Deaf and Dumb.

1900. French, Morris S., M.D.

1893. Friebis, George, M.D., Ophthalmic Surgeon to the Lutheran Home and Orphanage, Mt. Airy.

1899. Furness, William H., 3d, M.D.

1889. Fussell, M. Howard, M.D., Chief Physician to the Medical Dispensary of the Hospital of the University of Pennsylvania; Instructor in Clinical Medicine in the University of Pennsylvania.

ELECTED

1899. Gamble, Robert G., M.D., one of the Attending Physicians to the Bryn Mawr Hospital.

1873. Gerhard, George S., M.D.

1864. Getchell, F. H., M.D.

1902. Ghriskey, Albert A., M.D., Clinical Pathologist to the Episcopal Hospital.

1892. Gibb, Joseph S., M.D., Professor of Diseases of the Throat and Nose in the Philadelphia Polyclinic; Surgeon to the Ear, Nose, and Throat Department of the Episcopal Hospital.

1899. Gibbon, John H., M.D., Professor of Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Surgeon to the Bryn Mawr Hospital; Surgeon to the Out-patient Departments of the Pennsylvania and the Children's Hospitals.

1897. Girvin, John H., M.D., Physician for Diseases of Women at the Presbyterian Hospital; Assistant Demonstrator of Obstetrics in the University of Pennsylvania.

1889. Githens, William H. H., M.D., Visiting Physician to the Sheltering Arms.

1894. Gleason, E. B., M.D., Clinical Professor of Otology in the Medico-Chirurgical College; Surgeon-in-Charge of the Nose, Throat, and Ear Department of the Northern Dispensary.

1884. Godey, Harry, M.D.

1893. Goodell, W. Constantine, M.D.

†1897. Gould, George M., A.M., M.D.

1894. Graham, Edwin E., M.D., Clinical Professor of Diseases of Children in the Jefferson Medical College; Physician to the Franklin Reformatory Home.

1885. Graham, John, M.D.

1883. Griffith, J. P. Crozer, M.D., Clinical Professor of the Diseases of Children in the University of Pennsylvania; Physician to St. Agnes's, the Children's and the Methodist Hospitals.

*1889. Guitéras, John, M.D.

1902. Gwyn, Norman B., M.D., Instructor in Medicine in the University of Pennsylvania.

*1893. Hamill, Robert H., M.D., Summit, N. J.

1894. Hamill, Samuel McC., M.D., Professor of Diseases of Children in the Philadelphia Polyclinic and College for Graduates in

ELECTED

Medicine; Instructor in Clinical Medicine in the University of Pennsylvania; Physician to the Medical Dispensary of the Hospital of the University of Pennsylvania; Pediatrist to the Howard Hospital.

1897. Hand, Alfred, Jr., M.D., Physician to the Children's Hospital; Pathologist and Bacteriologist to the Bryn Mawr Hospital.

1886. Hansell, Howard F., M.D., Clinical Professor of Ophthalmology in the Jefferson Medical College; Professor of Diseases of the Eye in the Philadelphia Polyclinic; Consulting Ophthalmologist to the Chester County Hospital and to the Frederick Douglass Memorial Hospital.

1889. Hare, Hobart A., M.D., Professor of Therapeutics in the Jefferson Medical College; Physician to the Jefferson Medical College Hospital.

1865. Harlan, George C., M.D., Consulting Surgeon to the Wills Eye Hospital; Ophthalmic Surgeon to the Pennsylvania Hospital, and to the Pennsylvania Institution for the Blind; Emeritus Professor of Diseases of the Eye in the Philadelphia Polyclinic.

1902. Harland, William G. B., M.D., Instructor in Laryngology in the University of Pennsylvania; Aurist and Laryngologist to the Dispensary of the Presbyterian Hospital; Visiting Physician to the Philadelphia Home for Incurables.

1885. Harte, Richard H., M.D., Surgeon to the Pennsylvania and Episcopal Hospitals; Consulting Surgeon to St. Mary's and St. Timothy's Hospitals.

1888. Hartzell, Milton B., M.D., Instructor in Dermatology in the University of Pennsylvania; Dermatologist to the Methodist Episcopal Hospital.

1872. Hays, I. Minis, M.D.

1882. Hearn, W. Joseph, M.D., Clinical Professor of Surgery in the Jefferson Medical College; Surgeon to Philadelphia Hospital.

1901. Heisler, John C., M.D., Professor of Anatomy in the Medico-Chirurgical College.

1884. Henry, Frederick P., M.D., Physician to the Philadelphia Hospital; Professor of the Principles and Practice of Medicine in the Woman's Medical College of Pennsylvania.

ELECTED

1891. Hewson, Addinell, A.M., M.D., Demonstrator of Anatomy in the Jefferson Medical College; Professor of Anatomy in the Philadelphia Polyclinic and College for Graduates in Medicine; Surgeon to St. Timothy's Hospital, Roxborough; Senior Surgeon to the Dispensary of the Episcopal Hospital.

1872. Hinckle, A. G. B., M.D.

1897. Hinckle, William M., M.D, Lecturer on the Anatomy and Physiology of the Vocal Organs in the National School of Elocution and Oratory.

1892. Hinsdale, Guy, M.D., Consulting Physician to the Presbyterian Orphanage; Assistant Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases and to the Presbyterian Hospital.

1888. Hirsh, A. Bern., M.D., Physician to the Home for Aged Couples.

1888. Hirst, Barton Cooke, M.D., Professor of Obstetrics in the University of Pennsylvania; Gynecologist to the Philadelphia and Howard Hospitals.

1894. Hoch, William R., M.D., Instructor in Laryngology in the University of Pennsylvania; Laryngologist to the Methodist Episcopal Hospital.

1885. Holland, James W., M.D., Professor of Medical Chemistry and Toxicology in the Jefferson Medical College.

†1879. Hopkins, William Barton, M.D., Surgeon to the Pennsylvania Hospital.

1888. Horwitz, Orville, M.D., Professor of Genito-Urinary Diseases in the Jefferson Medical College; Surgeon to the Philadelphia Hospital and to the State Hospital for the Insane; Consulting Surgeon to the Hayes Mechanics' Home.

1868. Howell, Samuel B., M.D., Professor of Chemistry in the Medico-Chirurgical College.

1892. Hughes, William E., M.D., Professor of Clinical Medicine in the Medico-Chirurgical College; Visiting Physician to the Philadelphia and Medico-Chirurgical Hospitals; Pathologist to the Presbyterian Hospital.

1898. Hutchinson, James P., M.D., Surgeon to the Dispensaries of the Episcopal, Methodist, and Children's Hospitals.

1871. Ingham, James V., M.D.

ELECTED

*1885. Jackson, Edward, M.D., Denver, Colorado, Emeritus Professor of Diseases of the Eye in the Philadelphia Polyclinic.

1887. Jayne, Horace, M.D., Ph.D., Professor of Zoölogy in the University of Pennsylvania; Director of the Wistar Institute of Anatomy and Biology.

1898. Johnson, Russell H., A.B. (Princeton), M.D., Physician to the Pennsylvania Institution for the Deaf and Dumb.

1900. Jones, Charles James, A.M., M.D., Ophthalmic Surgeon to the House of the Good Shepherd, Germantown; Assistant Surgeon to the Wills Eye Hospital.

1900. Jopson, John H., M.D., Surgeon to the Children's Hospital, the Bryn Mawr Hospital, and the Philadelphia Home for Incurables; Surgeon to the Dispensary of the Episcopal Hospital and of the Presbyterian Hospital.

1885. Judd, Leonardo da Vinci, M.D.

1900. Judson, Charles F., A.B., M.D., Physician to the Episcopal Hospital and to St. Christopher's Hospital for Children; Physician to the Out-patient Departments of the Children's and the German Hospitals.

1902. Jump, Henry D., M.D., Instructor in Clinical Medicine in the University of Pennsylvania; Assistant Physician to the Medical Dispensary of the University Hospital.

1886. Jurist, Louis, M.D.

†1867. Keen, William W., M.D., LL.D., F.R.C.S. (Hon.), Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College; Membre Correspondant Étranger de la Société de Chirurgie de Paris; Honorary Member of the Société Belge de Chirurgie and of the Clinical Society of London; Ehrenmitglied der Deutschen Gesellschaft für Chirurgie.

1897. Kelly, Aloysius O. J., M.D., Instructor in Clinical Medicine in the University of Pennsylvania; Assistant Physician to the University Hospital; Clinical Professor of Pathology in the Woman's Medical College of Pennsylvania; Visiting Physician to St. Mary's and St. Agnes's Hospitals; Pathologist to the German Hospital.

*1887. Kelly, Howard A., M.D., Professor of Gynecology in Johns Hopkins University and Gynecologist to the Johns Hopkins Hospital, Baltimore, Md.

ELECTED

1898. Kempton, Augustus F., M.D.

1902. King, William Howard, M.D.

1895. Kneass, Samuel S., M.D., Associate in the William Pepper Laboratory of Clinical Medicine in the University of Pennsylvania.

1900. Krusen, Wilmer, M.D., Instructor in Gynecology in the Jefferson Medical College; Assistant Gynecologist and Chief of the Gynecological Dispensary of St. Joseph's Hospital; Consulting Gynecologist to the Children's Hospital in Germantown.

1897. Kyle, D. Braden, M.D., Clinical Professor of Laryngology, Rhinology, and Otology in the Jefferson Medical College; Consulting Laryngologist, Rhinologist, and Otologist to St. Agnes's Hospital and to the Philadelphia Home for Incurables; Laryngologist to the New Jersey Training School for Feeble-minded Children; Bacteriologist to the Orthopædic Hospital and Infirmary for Nervous Diseases.

*1892. Lainé, Damaso T., M.D., Havana, Cuba.

1865. La Roche, C. Percy, M.D.

1887. Leaman, Henry, M.D.

1893. Le Conte, Robert G., A.B., M.D., Surgeon to the Pennsylvania, the Children's, the Germantown, and the Bryn Mawr Hospitals.

1892. Leidy, Joseph, M.D., Physician to the Out-patient Department of the Pennsylvania Hospital; Consulting Physician to the Pennsylvania Training School for Feeble-minded Children.

1877. Lewis, Morris J., M.D., Physician to the Children's Hospital, to the Orthopædic Hospital and Infirmary for Nervous Diseases and to the Pennsylvania Hospital.

1886. Lloyd, J. Hendrie, M.D., Physician to the Methodist Episcopal Hospital and to the Home for Crippled Children; Consulting Neurologist to the State Asylum for the Chronic Insane of Pennsylvania and to the Pennsylvania Training School for Feeble-minded Children.

1900. Lodge, John W., M.D., Consulting Physician to the Bryn Mawr Hospital.

1893. Longaker, Daniel, M.D.

1877. Longstreth, Morris, M.D.

ELECTED

1900. McCarthy, Daniel J., M.D., Instructor in Neurology in the Philadelphia Polyclinic; Associate of the William Pepper Laboratory of Clinical Medicine.

1875. McClellan, George, M.D., Consulting Surgeon to the Howard Hospital.

1895. McFarland, Joseph, M.D., Professor of Pathology and Bacteriology in the Medico-Chirurgical College; Pathologist to the Medico-Chirurgical and the Philadelphia Hospitals.

1900. McReynolds, Robert Phillips, M.D., One of the Resident Chiefs and one of the Chiefs of the Gynecological Dispensary of the Presbyterian Hospital.

1886. MacCoy, Alexander W., M.D., Surgeon for Diseases of the Nose and Throat in the Out-patient Department of the Pennsylvania Hospital; Member of the American Laryngological Society.

1901. MacLeod, George L., Jr., M.D., Registrar of the Bryn Mawr Hospital.

1896. Makuen, G. Hudson, M.D., Professor of Defects of Speech in the Philadelphia Polyclinic; Laryngologist to St. Mary's Hospital and to the Frederick Douglass Memorial Hospital; Visiting Consultant on Defects of Speech to the New Jersey Training School for Feeble-minded Children.

*1885. Mallet, John William, M.D., Ph.D. (Goett.), LL.D. (Princeton), F.R.S., Professor of Chemistry in the University of Virginia.

1898. Marshall, George Morley, M.D., Laryngologist to the Philadelphia Hospital; Physician and Laryngologist to St. Joseph's Hospital.

1893. Marshall, John, M.D., Nat. Sc. D., LL.D., Professor of Chemistry and Toxicology in the University of Pennsylvania.

1889. Martin, Edward, M.D., Professor of Clinical Surgery in the University of Pennsylvania; Surgeon to the University, Howard, St. Agnes's, Philadelphia and Bryn Mawr Hospitals.

1885. Mays, Thomas J., M.D., Visiting Physician to the Rush Hospital.

*1868. Mears, J. Ewing, M.D.

ELECTED

1875. Meigs, Arthur V., M.D., Physician to the Pennsylvania Hospital; Consulting Physician to the Pennsylvania Institution for the Instruction of the Blind.

*1884. Mifflin, Houston, M.D., Columbia, Pa.

1894. Miller, D. J. Milton, M.D., Physician to the Episcopal Hospital; Assistant Physician to the Children's Hospital.

1881. Mills, Charles K., M.D., Clinical Professor of Nervous Diseases in the University of Pennsylvania; Neurologist to the Philadelphia Hospital.

†1888. Mitchell, John K., M.D., Assistant Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Assistant Neurologist to the Presbyterian Hospital; Attending Physician to the Pennsylvania Training School for Feeble-minded Children.

1856. Mitchell, S. Weir, M.D., M. Nat. Ac. Sci., LL.D. (Harvard, Edinburgh and Princeton); M.D. *Honoris Causa* (Bologna, Italy); Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Physician to the Presbyterian Hospital.

1882. Montgomery, Edward E., M.D., Professor of Gynecology in the Jefferson Medical College; Gynecologist to the Jefferson and St. Joseph's Hospital.

1863. Morehouse, George Read, M.D., Ph.D. (Princeton), Consulting Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases.

1886. Morris, Caspar, M.D.

1893. Morris, Elliston, J., M.D., Physician to the Episcopal Hospital, the Sheltering Arms and the Midnight Mission.

1883. Morris, Henry, M.D., Visiting Physician to St. Joseph's Hospital.

1856. Morris, J. Cheston, M.D.

1897. Morton, Samuel W., M.D.

1861. Morton, Thomas G., M.D., Senior Surgeon and President of the Medical Staff of the Pennsylvania Hospital; Fellow of the American Surgical Association.

1891. Morton, Thomas S. K., M.D., Professor of Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Surgeon to the Out-patient Department of the Pennsylvania Hospital; Consulting Surgeon to the Woman's Hospital and the Philadelphia Dispensary.

ELECTED

1864. Moss, William, M.D.

1890. Müller, Auguste F., M.D., Attending Physician to the Germantown Hospital.

1882. Musser, John H., M.D., Professor of Clinical Medicine in the University of Pennsylvania; Physician to the University, the Philadelphia and the Presbyterian Hopitals.

1896. Myers, T. D., M.D.

1902. Nassau, Charles F., M.D., Surgeon to St. Joseph's Hospital; Physician to the Dispensary for Women of the German Hospital.

1886. Neff, Joseph S., M.D.

1887. Neilson, Thomas Rundle, M.D., Surgeon to the Episcopal Hospital and to St. Christopher's Hospital for Children; Clinical Assistant Professor of Genito-urinary Diseases in the University of Pennsylvania.

1899. Nicholson, William R., Jr., M.D., Instructor in Gynecology and Assistant Demonstrator of Obstetrics in the University of Pennsylvania; Obstetrician to the Maternity Hospital; Assistant Surgeon to the Gynecean Hospital.

1889. Noble, Charles P., M.D., Surgeon-in-Chief to the Kensington Hospital for Women; Surgeon-in-Charge of the Department for Women of the Northern Dispensary and of the Union Mission Hospital; Clinical Professor of Gynecology in the Woman's Medical College of Pennsylvania; Lecturer on Gynecology in the Philadelphia Polyclinic.

1893. Noble, William H., M.D.

1898. Nolan, Edward J., M.D., Recording Secretary and Librarian of the Academy of Natural Sciences of Philadelphia.

1901. Norris, Henry, M.D., Chief of the Surgical Dispensary of the Hospital of the University of Pennsylvania; Clinical Assistant in the Clinic for Genito-urinary Surgery in the Polyclinic Hospital.

1869. Norris, Herbert, M.D.

1865. Norris, Isaac, M.D.

1892. Norris, Richard C., M.D., Lecturer on Clinical and Operative Obstetrics in the University of Pennsylvania; Obstetrician in Charge to the Preston Retreat; Visiting Obstetrician to the Philadelphia Hospital; Gynecologist to the Methodist

ELECTED

Hospital and Consulting Obstetrician and Attending Gynecologist to the Southeastern Dispensary and Hospital.

1884. Oliver, Charles A., A.M., M.D., Surgeon to the Wills Eye Hospital; Ophthalmic Surgeon to the Philadelphia and the Presbyterian Hospitals; Consulting Ophthalmic Surgeon to St. Timothy's Hospital.

1884. O'Neill, J. Wilks, M.D.

*1885. Osler, William, M.D., Professor of Medicine in Johns Hopkins University and Physician to the Johns Hopkins Hospital, Baltimore, Md.

1897. Packard, Francis R., M.D., Aurist to the Out-patient Department of the Pennsylvania Hospital; Professor of Diseases of the Ear in the Philadelphia Polyclinic and College for Graduates in Medicine; Consulting Aurist to the Bryn Mawr Hospital; Editor of the *American Journal of the Medical Sciences.*

1858. Packard, John H., M.D., Late Surgeon to the Pennsylvania Hospital; Surgeon Emeritus to St. Joseph's Hospital.

1898. Page, Henry F., M.D., Assistant Physician to the German Hospital and Physician to the Medical Dispensary of the same; Instructor in Clinical Medicine in the Woman's Medical College of Pennsylvania; Physician to the Baptist Home.

1882. Parish, William H., M.D., Professor of Obstetrics in the Dartmouth Medical College; Professor of Anatomy in the Woman's Medical College of Pennsylvania; Consulting Obstetrician to the Lying-in Charity Hospital; Consulting Surgeon to the Kensington Hospital; Medical Director and Gynecologist to St. Agnes's Hospital.

1899. Parke, William E., M.D., Assistant Surgeon in the Department for Diseases of Women in the Northern Dispensary; Clinical Assistant and Surgeon to the Dispensary of the Kensington Hospital for Women.

1898. Pearce, F. Savary, M.D., Clinical Professor of Nervous and Mental Diseases in the Medico-Chirurgical College of Philadelphia; Neurologist to the Philadelphia and Howard Hospitals; Secretary of the Section on Nervous and Mental Diseases of the American Medical Association.

ELECTED

†1889. Penrose, Charles Bingham, M.D., Ph.D. (Harvard). Formerly Professor of Gynecology in the University of Pennsylvania.

1854. Penrose, R. A. F., M.D., LL.D., Professor (Emeritus) of Obstetrics and Diseases of Women and Children in the University of Pennsylvania.

†1902. Pepper, William, M.D., Pathologist to St. Christopher's Hospital for Children; Assistant Instructor in Clinical Medicine in the University of Pennsylvania.

1884. Perkins, Francis M., M.D., Ophthalmic Surgeon to St. Agnes's Hospital.

1899. Phillips, John L, M.D.

1883. Piersol, George A., M.D., Professor of Anatomy in the University of Pennsylvania.

1872. Porter, William G., M.D., Surgeon to the Presbyterian Hospital; Consulting Physician to the Philadelphia Dispensary and to the Educational Home for Boys.

1896. Posey, William Campbell, M.D., Surgeon to the Wills Eye Hospital; Professor of Ophthalmology in the Philadelphia Polyclinic and College for Graduates in Medicine; Ophthalmic Surgeon to the Howard Hospital; Ophthalmologist to the Pennsylvania Hospital for Epileptics.

1885. Potter, Thomas C, M.D.

1902. Potts, Barton H., M.D., Associate in Diseases of the Ear in the Philadelphia Polyclinic and College for Graduates in Medicine; Aurist and Laryngologist to St. Mary's Hospital; Aurist and Laryngologist to the Out-patient Department of the German Hospital; Assistant Aurist and Ophthalmologist to the Children's Hospital.

1899. Potts, Charles S., M.D., Instructor in Nervous Diseases and Electro-therapeutics in the University of Pennsylvania; Assistant Neurologist to the University Hospital; Neurologist to the Philadelphia Hospital; Consulting Physician to the Hospital for the Insane, Atlantic County, New Jersey.

†1899. Price, Joseph, M.D., Obstetric Physician to the Philadelphia Dispensary.

1887. Randall, B. Alexander, M.A., M.D., Clinical Professor of Diseases of the Ear in the University of Pennsylvania; Eye

ELECTED

and Ear Surgeon to the Children's Hospital; Consulting Aurist to the Pennsylvania Institution for the Deaf and Dumb and to St. Timothy's Hospital.

1887. Reed, Charles H., M.D.

1885. Reichert, Edward T., M.D., Professor of Physiology in the University of Pennsylvania.

1897. Rhein, John H. W., M.D., Neurologist to St. Agnes's Hospital; Assistant Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Physician to the Philadelphia Home for Incurables; Bacteriologist to the Pennsylvania Training School for Feeble-minded Children.

1891. Rhoads, Edward G., M.D.

1898. Riesman, David, M.D., Professor of Clinical Medicine in the Philadelphia, Polyclinic; Instructor in Clinical Medicine in the University of Pennsylvania; Physician to the Philadelphia Hospital; Neurologist to the Northern Dispensary.

1895. Ring, G. Oram, M.D., Ophthalmic Surgeon to the Episcopal Hospital; Ophthalmic and Aural Surgeon to the Samaritan Hospital.

1891. Risley, S. D., M.D., Attending Surgeon to the Wills Eye Hospital; Professor (Emeritus) of Ophthalmology in the Philadelphia Polyclinic and College for Graduates in Medicine; Member of the Board of Managers of the Pennsylvania Training School for Feeble-minded Children; Alumnus Manager of the University Hospital.

†1878. Roberts, John B., M.D., Professor of Anatomy and Surgery in the Philadelphia Polyclinic; Surgeon to the Methodist Hospital.

1899. Roberts, Walter, M.D., Instructor in Otology in the Philadelphia Polyclinic; Clinical Assistant for Diseases of the Nose and Throat in the Out-patient Department of the Pennsylvania Hospital.

*1888. Robins, Robert P., M.D.

1902. Robinson, James Weir, M.D., Assistant Surgeon to the Presbyterian Hospital.

1900. Rodman, William L., M.D., Professor of the Principles of Surgery and Clinical Surgery in the Medico-Chirurgical College; Professor of the Principles and Practice of Surgery in the Woman's Medical College of Pennsylvania.

ELECTED

1898. Ross, George G., M.D., Assistant Surgeon to the German Hospital and Surgeon to the Out-patient Department of the same; Surgeon to the Germantown Hospital.

1897. Sailer, Joseph, M.D., Associate in the Pepper Clinical Laboratory in the University of Pennsylvania; Pathologist to the Pennsylvania Training School for Feeble-minded Children.

1900. Sajous, Charles E. de M., M.D.

†1866. Schäffer, Charles, M.D.

1899. Schamberg, Jay F., M.D., Professor of Dermatology and Infectious Eruptive Diseases in the Philadelphia Polyclinic and College for Graduates in Medicine; Assistant Physician to the Municipal Hospital for Infectious Diseases.

1887. de Schweinitz, George E., M.D., Professor of Ophthalmology in the University of Pennsylvania; Ophthalmologist to the Orthopædic Hospital and Infirmary for Nervous Diseases; Ophthalmic Surgeon to the Philadelphia Hospital; Consulting Ophthalmologist to the Philadelphia Polyclinic and College for Graduates in Medicine.

1895. Scott, J. Alison, M.D., Professor of Clinical Medicine in the Philadelphia Polyclinic and College for Graduates in Medicine; Instructor in Clinical Medicine in the University of Pennsylvania; Visiting Physician to the Pennsylvania Hospital; Physician to the Church Home for Children.

1892. Seiss, Ralph W., M.D., Professor of Otology in the Philadelphia Polyclinic; Consulting Laryngologist to the Pennsylvania Institution for the Deaf and Dumb.

1884. Shaffner, Charles, A.M., M.D.

1897. Sharpless, W. T., M.D., Physician to the Chester County Hospital, West Chester, Pa.

1876. Shippen, Edward, A.M. (Princeton), M.D., Medical Director U. S. Navy (retired).

1891. Shober, John B., A.M., M.D., Associate Gynecologist to the Gynecean Hospital; Gynecologist to the Howard Hospital; Obstetrician to the Philadelphia Hospital.

1890. Shoemaker, George Erety, A.M., M.D., Gynecologist to the Presbyterian Hospital and to the Pennsylvania Epileptic Hospital and Colony Farm.

ELECTED

†1893. Shoemaker, Harvey, M.D., Visiting Physician to the Sheltering Arms and to the Southern Home for Destitute Children; Assistant Physician to the German Hospital; Physician to the Out-patient Departments of the German and Pennsylvania Hospitals.

†1896. Shoemaker, William T., M.D., Assistant Ophthalmologist to the German Hospital and Ophthalmic Surgeon to the Out-patient Department of the same; Ophthalmic Surgeon to the Out-patient Department of the Presbyterian Hospital; Ophthalmologist to the Southern Home for Destitute Children; Oculist to the Pennsylvania Institution for the Deaf and Dumb.

1900. Shumway, Edward Adams, B.S., M.D., Ophthalmologist to the Presbyterian Home for Widows and Single Women; Assistant Ophthalmic Surgeon to the Dispensary of the University Hospital.

1880. Simes, J. Henry C., M.D., Emeritus Professor of Genito-urinary and Venereal Diseases in the Philadelphia Polyclinic.

1872. Sinkler, Wharton, M.D., Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Neurologist to the State Asylum for the Chronic Insane of Pennsylvania.

1902. Siter, E. Hollingsworth, M.D., Surgeon to the Dispensaries of the Children's and St. Agnes's Hospital and to the Dispensary for Children at the Presbyterian Hospital; Assistant Surgeon to the Dispensary for Genito-urinary Diseases in the University Hospital; Instructor in Genito-urinary Diseases in the Philadelphia Polyclinic and College for Graduates in Medicine; Surgeon to the British Consulate in Philadelphia and to the British Sailors' Ward in St. Agnes's Hospital.

1895. Slocum, Harris A., M.D., Professor of Gynecology in the Philadelphia Polyclinic; Gynecologist to St. Clement's Hospital for Epileptics.

1895. Spellissy, Joseph M., A.M., M.D., Surgeon to St. Joseph's and the Methodist Episcopal Hospitals; Assistant Surgeon to Orthopædic Dispensary of University Hospital; Surgeon to the Out-patient Department of the Pennsylvania Hospital.

1897. Spiller, William G., M.D., Assistant Clinical Professor of Nervous Diseases in the University of Pennsylvania; Clinical

ELECTED

Professor of Nervous Diseases in the Woman's Medical College of Pennsylvania; Professor of Nervous Diseases in the Philadelphia Polyclinic and College for Graduates in Medicine; Neurologist to the Philadelphia Hospital.

1894. Stahl, B. Franklin, Ph.G., B.S., M.D., Instructor in Physical Diagnosis and Lecturer on Dieteties of the Sick in the University of Pennsylvania; Visiting Physician to St. Agnes's Hospital; Neurological Registrar to Philadelphia Hospital.

1875. Starr, Louis, M.D.

1898. Steele, J. Dutton, M.D., Instructor in Medicine in the University of Pennsylvania; Physician to the Medical Dispensary of the University Hospital; Bacteriologist to the Presbyterian Hospital.

1892. Steinbach, Lewis W., M.D., Professor of Clinical and Operative Surgery in the Philadelphia Polyclinic; Visiting Surgeon to the Philadelphia and the Jewish Hospitals.

1884. Stelwagon, Henry W., M.D., Ph.D., Clinical Professor of Dermatology in the Jefferson Medical College and in the Woman's Medical College; Physician to the Department for Skin Diseases of the Howard Hospital; Socio Corrispondente di la Societa Italiano di Dermatologia e Sifilografia.

1895. Stengel, Alfred, M.D., Professor of Clinical Medicine in the University of Pennsylvania; Physician to the University, Pennsylvania and Children's Hospitals.

1901. Stevens, Arthur A., M.D., Professor of Pathology in the Woman's Medical College of Pennsylvania; Lecturer on Physical Diagnosis in the University of Pennsylvania; Physician to the Episcopal and to St. Agnes's Hospitals.

1888. Stewart, David D., M.D., Attending Physician to the Episcopal Hospital; Consulting Physician to the Kensington Hospital for Women.

1902. Stewart, Francis T., M.D., Assistant Surgeon to the Jefferson Medical College Hospital; Associate in Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Surgeon to the Out-patient Department of the Pennsylvania Hospital.

1898. Stiles, George M., M.D.

1898. Stout, George C., M.D., Professor of Otology in the Philadelphia Polyclinic and College for Graduates in Medicine;

ELECTED

Laryngologist and Aurist to the Presbyterian Hospital, the Children's Aid Society, and to the William Penn Charter School.

1884. Stryker, Samuel S., M.D., Physician to the Presbyterian Hospital.

1900. Swan, John M., M.D., Demonstrator of Osteology and Assistant Demonstrator of Anatomy in the University of Pennsylvania; Dispensary Physician to the Presbyterian Hospital.

1898. Sweet, William M., M.D., Demonstrator of Ophthalmology in the Jefferson Medical College; Assistant Attending Ophthalmic Surgeon to the Jefferson Medical College Hospital; Ophthalmic Surgeon to the Phœnixville Hospital.

1900. Talley, James Ely, A.B., M.D., Physician to the Out-patient Department of the Presbyterian Hospital; Assistant and Consulting Physician to the Country Branch of the Children's Hospital.

1901. Taylor, J. Gurney, M.D.

1886. Taylor, John Madison, M.D., Pediatrist to the Philadelphia Hospital; Assistant Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Assistant Physician to the Children's Hospital.

1887. Taylor, William J., M.D., Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases, and to St. Agnes's Hospital; Consulting Surgeon to the West Philadelphia Hospital for Women.

1886. Taylor, William L., M.D.

1867. Thomas, Charles Hermon, M.D.

1897. Thomson, A. G., M.D., Ophthalmic Surgeon to the Children's Hospital; Assistant Surgeon to Wills Eye Hospital; Assistant Ophthalmologist to the Orthopædic Hospital and Infirmary for Nervous Diseases.

†1869. Thomson, William, M.D., Emeritus Professor of Ophthalmology in the Jefferson Medical College; Surgeon to Wills Eye Hospital.

1896. Thorington, James, A.M., M.D., Professor of Diseases of the Eye in the Philadelphia Polyclinic.

1898. Thornton, Edward Q., M.D., Assistant Professor of Materia Medica in the Jefferson Medical College.

ELECTED

1896. Toulmin, Harry, M.D., Assistant Medical Director of the Penn Mutual Life Insurance Company.

1901. Tucker, Henry, M.D.

†1894. Tunis, Joseph Price, M.D., Formerly Assistant Demonstrator of Anatomy and of Surgery in the University of Pennsylvania; Surgeon to the Methodist Hospital.

1901. Turner, John B., M.D., Clinical Assistant at the Wills Eye Hospital.

1866. Tyson, James, A.M., M.D., Professor of Medicine in the University of Pennsylvania and Physician to the Hospital of the University of Pennsylvania; Physician to the Philadelphia Hospital; Member of the Association of American Physicians.

1897. Tyson, T. Mellor, M.D., Assistant Physician to the Hospital of the University of Pennsylvania; Physician to the Rush Hospital, the Philadelphia Lying-in Charity Hospital and the Children's Aid Society of Philadelphia.

1873. Van Harlingen, Arthur, Ph.B. (Yale), M.D., Emeritus Professor of Dermatology in the Philadelphia Polyclinic; Dermatologist to the Children's Hospital.

1893. Vansant, Eugene Larue, M.D., Professor of Diseases of the Throat and Nose in the Philadelphia Polyclinic; Visiting Physician to the Throat, Nose and Ear Department of the Howard Hospital.

1897. Veasey, Clarence A., M.D., Adjunct Professor of Diseases of the Eye in the Philadelphia Polyclinic and College for Graduates in Medicine; Demonstrator of Ophthalmology in the Jefferson Medical College; Chief Clinical Assistant to the Ophthalmological Department of the Jefferson Medical College Hospital; Consulting Ophthalmologist to the Philadelphia Lying-in Charity Hospital.

†1883. Vinton, Charles Harrod, M.D.

1885. Walker, James B., M.D., Ph.D., Consulting Physician to the West Philadelphia Hospital for Women and Children.

1893. Warren, Joseph W., M.D., Associate Professor of Physiology in Bryn Mawr College.

1895. Watson, Arthur W., M.D., Professor of Diseases of the Throat and Nose in the Philadelphia Polyclinic; Laryngologist to the Howard Hospital and to the Hospital for Diseases of the Lungs, Chestnut Hill.

ELECTED

1886. Watson, Edward W., M.D.

1875. Webb, William H., M.D.

1883. Welch, William M., M.D., Physician-in-Charge of the Municipal Hospital for Contagious Diseases; Consulting Physician to the Northern Dispensary and to the Northern Home for Friendless Children.

1897. Wells, William H., M.D., Adjunct Professor of Obstetrics and Diseases of Infancy in the Philadelphia Polyclinic; Demonstrator of Clinical Obstetrics in the Jefferson Medical College.

1893. Westcott Thompson S., M.D., Instructor in Diseases of Children in the University of Pennsylvania; Visiting Physician to the Methodist Episcopal Hospital; Assistant Physician to the Children's Hospital.

1884. Wharton, Henry R., M.D., Clinical Professor of Surgery in the Woman's Medical College of Pennsylvania; Surgeon to the Presbyterian and Children's Hospital; Consulting Surgeon to the Bryn Mawr Hospital, St. Christopher's Hospital for Children and the Pennsylvania Institution for the Deaf and Dumb.

1901. White, Courtland Y., M.D., Assistant Director of the William Pepper Laboratory of Clinical Medicine; Instructor of Clinical Medicine in the University of Pennsylvania; Assistant Physician to the University Hospital; Demonstrator of Pathology in the Veterinary Department of the University of Pennsylvania.

1878. White, J. William, M.D., Ph.D., John Rhea Barton Professor of Surgery in the University of Pennsylvania; Surgeon to the University Hospital; Fellow of the American Surgical Association and of the American Association of Genito-Urinary Surgeons.

1898. Whiting, Albert D., M.D., Assistant Surgeon and Registrar to the German Hospital, and Surgeon to the Out-patient Department of the same; Physician to the Southern Home for Destitute Children.

†1880. Willard, De Forest, A.M., M.D., Ph.D., Clinical Professor of Orthopedic Surgery in the University of Pennsylvania; Surgeon to the Presbyterian Hospital; President of the American Surgical Association; Chairman of the Surgical Section of the American Medical Association.

ELECTED

*1878. Williamson, Jesse, M.D., Wilmington, Delaware, one of the Surgeons to the Delaware Hospital.

1902. Willson, Robert N., Jr., M.D., Instructor in Physical Diagnosis, and Students' Physician in the University of Pennsylvania.

1881. Wilson, H. Augustus, M.D., Emeritus Professor of Orthopedic Surgery in the Philadelphia Polyclinic; Clinical Professor of Orthopedic Surgery in the Jefferson Medical College; Consulting Orthopedic Surgeon to the Philadelphia Lying-in Charity Hospital and to the Kensington Hospital for Women.

1874. Wilson, James C., M.D., Professor of the Practice of Medicine and of Clinical Medicine in the Jefferson Medical College, and Physician to the Hospital of the same (Faculty Staff); Physician-in-Chief to the German Hospital; Attending Physician to the Pennsylvania Hospital.

1902. Wilson, Samuel M., M.D.

1897. Wilson, W. Reynolds, M.D., Visiting Physician to the Philadelphia Lying-in Charity Hospital.

*1901. Witmer, A. Ferree, M.D., New York.

1893. Wood, Alfred C., M.D., Demonstrator of Surgery in the University of Pennsylvania; Assistant Surgeon to the University Hospital; Surgeon to the Philadelphia Hospital.

1900. Wood, George B., M.D, Instructor in Laryngology in the University of Pennsylvania; Assistant in the Clinic for Diseases of the Nose and Throat at the Polyclinic Hospital.

1865. Wood, Horatio C., M.D., LL.D. (Yale and Lafayette); Professor of Materia Medica and Therapeutics in the University of Pennsylvania; Associate Fellow in Medicine and Surgery of the American Academy of Arts and Sciences; Member of the National Academy of Science.

1880. Woodbury, Frank, M.D., Associate in Laryngology in the Philadelphia Polyclinic.

1866. Woods, D. F., M.D., Physician to the Presbyterian Hospital.

1901. Woods, Richard F., M.D., Assistant Surgeon to the Gynecean Hospital.

1888. Woodward, Charles E., M.D., Secretary of the West Chester Board of Health; U. S. Examining Surgeon; Member of the Medical Staff of the Chester County Hospital.

ELECTED

†1897. Woodward, George, M.D.

1860. Wurts, Charles Stewart, M.D.

1868. Yarrow, Thomas J., M.D.

1889. Young, James K., M.D., Professor of Orthopedic Surgery in the Philadelphia Polyclinic; Clinical Professor of Orthopedic Surgery in the Woman's Medical College of Pennsylvania; Instructor in Orthopedic Surgery in the University of Pennsylvania and Assistant Orthopedic Surgeon to the University Hospital.

1894. Zentmayer, William, M.D., Attending Surgeon to Wills Eye Hospital; Ophthalmic Surgeon to St. Mary's Hospital; Ophthalmologist to the House of Refuge.

1899. Ziegler, S. Lewis, M.D., Attending Surgeon to Wills Eye Hospital; Ophthalmic Surgeon to St. Joseph's Hospital; Membre Société Française d'Ophthalmologie.

1887. Ziegler, Walter M. L., A.M., M.D.

1895. Zimmerman, Mason W., M.D., Ophthalmic Surgeon to the Germantown Hospital and to St. Christopher's Hospital for Children.

ASSOCIATE FELLOWS.

[Limited to Fifty, of whom Twenty may be Foreigners.]

American.

ELECTED

1876. Billings, John S., M.D., U. S. A. (retired), New York.
1886. Bowditch, Henry P., M.D., Boston, Massachusetts.
1877. Chaillé, Stanford E., M.D., New Orleans, Louisiana.
1886. Cheever, David W., M.D., Boston, Massachusetts.
1896. Conner, Phineas Sanborn, M.D., Cincinnati, Ohio.
1893. Councilman, William T., M.D., Boston, Massachusetts.
1876. Davis, N. S., M.D., Chicago, Illinois.
1892. Emmet, Thomas Addis, M.D., New York.
1892. Fitz, Reginald H., M.D., Boston, Massachusetts.
1895. Fletcher, Robert, M.D., Washington, D. C.
1891. Jacobi, A., M.D., New York
1895. McBurney, Charles, M.D., New York.
1886. Reeve, John C., M.D., LL.D., Dayton, Ohio.
1886. Senn, Nicholas, M.D., Chicago, Illinois.
1896. Sternberg, George M., M.D., U. S. A., Washington, D. C.
1886. Thomas, T. Gaillard, M.D., New York.
1896. Tiffany, L. McLane, M.D., Baltimore, Maryland.
1894. Warren, J. Collins, M.D., Boston, Massachusetts.
1894. Weir, Robert F., M.D., New York.
1892. Welch, William H., M.D., Baltimore, Maryland.

Foreign.

1890. Baccelli, Guido, Rome, Italy.
1877. Barnes, Robert, M.D., London, England.
1894. Brunton, Sir T. Lauder, M.D., London, England.

ELECTED

1883. Fayrer, Sir Joseph, M.D., LL.D., F.R.S., London, England.
1899. Fraser, Thomas R., M.D., LL.D., F.R.C.P., F.R.S., Edinburgh, Scotland.
1883. Heath, Christopher, F.R.C.S., London, England.
1896. Jaccoud, Prof. S., M.D., Paris, France.
1874. Jackson, J. Hughlings, M.D., London, England.
1893. v. Jaksch, Rudolf, M.D., Prague, Bohemia.
1896. Leyden, Ernst, M.D., Berlin, Germany.
1877. Lord Lister, M.D., LL.D., F.R.S., London, England.
1873. Ogle, John W., M.D., London, England.
1898. Roddick, Thomas G., M.D., Montreal, Canada.
1896. Pye-Smith, P. H., M.D., London, England.
1869. Valcourt, Th. de, M.D., Cannes, France.

CORRESPONDING MEMBERS.

ELECTED

1880. Carrow, Flemming, M.D., United States.
1880. Chiara, Domenico, M.D., Florence, Italy.
1886. Dey, Kanny Lall, M.D., Calcutta, India.
1885. Rendu, Jean, M.D., Lyons, France.

NECROLOGICAL LIST.

FELLOWS.

WILLIAM H. GOBRECHT (Non-resident),	July 20, 1901.
WILLIAM C. DIXON,	January 10, 1902.
JOHN T. ESKRIDGE (Non-resident),	January 16, 1902.
CHARLES H. BURNETT,	January 30, 1902.
FRANCIS W. LEWIS,	March 2, 1902.
CHARLES WIRGMAN,	April 19, 1902.
MEREDITH CLYMER (Non-resident),	April 20, 1902.
EDWARD B. VANDYKE,	August 31, 1902.
FREDERICK A. PACKARD,	November 1, 1902.

ASSOCIATE FELLOWS.

RUDOLF VIRCHOW,	September 5, 1902.
EDWARD MOTT MOORE,	March 3, 1902.

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MEMOIR OF JOHN ASHHURST, Jr., M.D.

By RICHARD H. HARTE, M.D.

[Read March 5, 1902.]

The subject of this sketch drew his first breath in the house occupied by his parents on Chestnut Street, between Tenth and Eleventh, on August 23, 1839. His progenitors were of English extraction, his paternal grandfather, Richard Ashhurst, coming to this country from Lancastershire in 1801, and establishing the house of Richard Ashhurst, importers and wholesale traders in dry goods. Later his father and brother were admitted to the firm, and the business was carried on under the name of Richard Ashhurst & Sons, until the early fifties, when they retired from the dry goods trade and engaged in the banking business until 1862. After his grandfather's death the firm withdrew from business and only retained their old office on Third Street.

He was a member of the Board of Trustees of the University of Pennsylvania, and married a daughter of Manual Eyre, a merchant engaged in the East India and China trade. Four children were born to them, two dying in early life, leaving Richard, the elder, and John. Dr. Ashhurst's mother was a woman of unusual force of character and of strong religious convictions. Hers was undoubtedly a strong influence in developing those traits of character so prominent in her son in after-life.

As a child he was delicate, often suffering from gastric and intestinal attacks; consequently he was deprived of many of the boyish sports to which his age would naturally have inclined him, and we find him more interested in books and indoor games, especially those

appealing to the imagination. He was very fond of music, and developed unusual skill in playing on the piano. On one occasion, at the age of six, his uncle, the late Wilson Eyre, took him to the seashore because of illness at home; shortly after his arrival in the hotel he was missed by his uncle, but was soon found in the parlor playing the piano to a large and admiring audience of women. It was not ordinary melody which attracted him most; he was but little interested in what the most of us would consider a pretty tune; his enjoyment was derived more from the scientific or the mathematical element in the art of music; later in life this was almost set aside by his more engrossing surgical interests, and only at rare intervals did he play for his family. When he was about six years of age his father obtained "The Grange," the historical country-seat of his maternal grandfather, Manuel Eyre, where the family afterward spent their summers. He was not sent to school as most boys, but was prepared for college by his mother and a Mr. Rees, who was first engaged as an instructor in music and afterward retained as tutor, as he was discovered to be a very good classical scholar. However, the last year of his college instruction was under the personal direction of a Mr. McAdam, who was quite eminent as a tutor in those days. In these beautiful surroundings he spent much of his time fishing in the creek and neighboring mill-dams, shooting a little, and also riding horseback. He took much pleasure in carpentering and working with tools. He was also much interested in collecting minerals, shells, and coins. The last-named collection he exchanged with his brother for books.

He was so far advanced in his studies that he was able to enter the Department of Arts in the University of Pennsylvania at the age of fourteen, and was graduated with the Bachelor's degree in 1857. While in college he was much interested in the study of chemistry, and for three years acted as Professor Frazer's assistant. He was also unusually proficient in mathematics. During his junior year he received the average of 14.997, the maximum being 15. This was the highest average ever attained by any student in the University. We find him actively interested in college matters, being one of the original members of the Phi Beta Kappa Fraternity, vice-president of his class, and a member of the Philomathean

Society, of which he was treasurer, second censor, secretary, and moderator. Upon graduation he delivered the Greek oration.

He entered the Medical Department of the University in the following autumn, under the personal guidance of Dr. Joseph Carson as preceptor, then Professor of Materia Medica, taking the three-year course, which was a year longer than was usually spent in the medical school at that time. During those days the Faculty was small, consisting of but seven members. Henry H. Smith was Professor of Surgery, and Dr. Agnew was lecturing to large classes in the old Philadelphia School of Anatomy. At the Jefferson College Dr. Joseph Pancoast was at the zenith of his glory, particularly as an operator, and I know he was regarded by Dr. Ashhurst as the most skilful operator he had ever known. Gross, the elder, was beginning that long career, both as author and teacher, which ended in placing him far beyond all competitors, and obtained for him the merited title of Master of American Surgery. At the Pennsylvania Hospital—at that time the only important hospital in the city—Norris and Peace were splendid examples of the conservative surgeon; Neill, clear and succinct, and Pancoast, the *beau ideal* of the operative school of surgery. With such teachers and such exemplars it is little wonder that surgical enthusiasm was most thoroughly and permanently implanted in his mind and bore such valuable fruit in the years to come. As a medical student he was greatly interested in the study of anatomy, especially the spinal nervous system. His wonderful capacity to comprehend and retain anatomical facts must have made the study very easy for him and a great pleasure for his instructors. On graduation the subject of his thesis was "Nervous Action," and it was selected by the Faculty for publication. In the same year he received his Master degree from the University. He was appointed Resident Physician at the Pennsylvania Hospital to fill the unexpired term of Dr. McCall, and served in that capacity for one year. While here Dr. Ashhurst showed himself to be the same industrious, painstaking, thorough, honest worker that he had been during his student days, and the good record made at that time had much to do toward securing many of his appointments in years afterward. I heard Dr. Ashhurst say that there was no period of a young physician's life that was more critically important than that

which he spent as a hospital resident, for the reputation which he then gains adheres to him in after-life, and often makes or mars his future.

Later, after the breaking out of the Civil War, he served as an assistant surgeon in the Chester United States Army Hospital, where he remained from August 13, 1861, to December, 1862. While he was in this hospital one of his colleagues complained that Ashhurst always had the best cases in his wards. This was accounted for by the fact that he was always present when the ambulances were carrying in the wounded, either from the trains or boats, and at a glance was able to recognize the more interesting cases surgically, and had them conveyed to the wards which were under his care, leaving the less acute observer to deal with the ordinary cases. During two years he served as surgeon and executive officer in the Cuyler United States Army General Hospital in Germantown. The following quite characteristic story of Dr. Ashhurst is related by Dr. Downs in regard to a patient who was an inmate of the United States Army Hospital at Broad and Cherry Streets. Having recovered from his injuries, he was about to be discharged and ordered to the front, but for some reason always managed to have some excuse why he should remain, and became a great nuisance to the medical staff, who succeeded in procuring his transfer to the United States Army Hospital in Germantown, where Dr. Ashhurst was then on duty. Before the patient's admission Dr. Ashhurst was informed by Dr. Downs that the patient was a malingerer, and the hope was expressed that he would immediately have him ordered to the front. His reply was: "I thank you, doctor, very much for the information in regard to the man, and after we have thoroughly satisfied ourselves that he is a malingerer I will report him for duty."

In 1863 he was elected attending surgeon to the Episcopal Hospital to succeed the late R. P. Thomas. This appointment entailed much laborious work, owing to the location of the hospital in the northern part of the city, so that in order to reach it one was obliged to ride in horse cars, which had their terminus a mile from the hospital, and from that point ran dummy engines, which were easily disarranged by trifling snows, so that on many occasions the remainder of the journey was accomplished on foot. In this insti-

tution Dr. Ashhurst soon became the leading surgical spirit, all cases of importance being referred to him, and his will was the dominant one practically from the time of his election to the surgical staff until he resigned, in 1880, to devote himself to the engrossing duties of the University of Pennsylvania as Professor of Clinical Surgery and Surgeon to the University Hospital.

After his resignation from the staff of the Episcopal Hospital he was elected a member of its Board of Managers; there he soon became one of its most active members in directing the affairs of the institution up to the time of his death.

As before stated, Dr. Ashhurst's love for books began almost as a child, and the foundation of his extensive library was laid very early in his career. Those of the Fellows who were in the habit of importing books from Europe will remember the well-known house of John Pennington & Son, a small store, or, perhaps, really more of a club, frequented by all book-lovers and collectors of books in the city. It was during Dr. Ashhurst's early associations here that he brought out the limited edition for private distribution of *Father Tom and the Pope*, and dedicated it to Le Cirele Autour du Poêle. He did not buy a book simply because it was a beautiful volume, but valued it for its historical associations and for its utility a great deal more than for mere beauty or rarity. He could appreciate a beautiful book, but did not order it on that account alone. Thus he cared more for an Aldus or a Plantin than for a Bodoni, and in the matter of binding would prefer a Roger Payne to a Charles Lewis or a Bauzonnet. One marked peculiarity of Dr. Ashhurst as a collector of books was the fact that he was thoroughly conversant with what they contained. One day, in speaking to me of a distinguished librarian in a neighboring city, he remarked that he knew much more about the outside of books than he did about the inside. Dr. Ashhurst had a large classical library, and probably as large a collection of Horaces as anyone in Philadelphia. He had also a great many French books, and was fond of early French literature. His library was also very full of standard English literature up to the close of the last century.

At the time of his death he possessed one of the most complete surgical libraries in the country, and, what is more, he was thor-

oughly conversant with what it contained, whether ancient or modern. The College has been greatly benefited because of his knowledge and ability in selecting valuable books, which are now permanently placed on her shelves, owing to his generous bequest of his entire library to the College, except such books as his sons may select for their own use. By his will his theological library was bequeathed to the Divinity School of the Episcopal Church in West Philadelphia.

It may be in keeping, while speaking of Dr. Ashhurst as a lover of books and as a book collector, to say something of his contributions to surgical literature. As a writer Dr. Ashhurst was noted for his correctness and the dignity of his style, his terseness in saying just what he meant in a few but well-chosen words, and his remarkable freedom from ambiguity. His earliest surgical work was *Injuries of the Spine*, which was published in 1865. In 1869 he edited Erichsen's *Science and Art of Surgery*, making valuable additions to the text. In 1871 he brought out his own *Principles and Practice of Surgery*, one of the most valuable text-books on surgery, which went through six editions, and for many years was the recognized text-book not only at the University of Pennsylvania, but at many of the medical schools throughout the country. He was editor of the *International Encyclopædia of Surgery*, in six volumes, appearing from 1881 to 1886. A French edition of this monumental work was brought out in 1883 to 1887. He edited the first five volumes of the TRANSACTIONS OF THE COLLEGE OF PHYSICIANS and the *Transactions of the International Medical Congress*, in 1876. He was one of the collaborators on Lippincott's *Medical Dictionary*, which appeared in 1897. He delivered the address on "Surgery Before the Days of Anæsthesia" at the semi-centennial anniversary of the discovery of ether, in the Massachusetts General Hospital, in Boston, October 16, 1896. He wrote nearly all of the reviews of surgical literature which appeared in the *American Journal of the Medical Sciences* between 1867 and 1874, which for style, clearness, and comprehensiveness will well repay a perusal of some of the old files of that journal. Can any person imagine a more clear and comprehensive *résumé* of a book than his review of Ollier's work on the *Surgery of the Bones?* It has been said that some of

his reviews were unnecessarily severe and caustic, but, nevertheless, they were true and accurate pen-pictures of the author's work, and were always signed by his own initials. On several occasions he refused to review the writings of some of his personal friends, feeling that he could not conscientiously give them the credit he should so much like to. He had great sympathy with men who wrote, feeling that they did it in a measure to make themselves more familiar with their subject. I well remember his saying, while descending the stairway after lecturing in the University, that if a man wanted to master a subject he must either teach it or write about it. Probably one reason why everything that he wrote gave so much pleasure to the reader was because of its perfect and simple style, his thoughts being clothed in the most appropriate and pleasing language, the fruit of a mind enriched by long and careful reading, and so certain of its data that he could draw on it at a moment's notice.

Dr. Ashhurst was elected to the Chair of Clinical Surgery in 1877, to succeed the late Dr. John Neill. I recall very vividly the first time I had the pleasure of seeing Dr. Ashhurst. It was when he came out to the University Hospital, shortly after his election, to take charge of the surgical wards. My friend Dr. Wharton was then the surgical resident, and I was substituting as an undergraduate in the medical wards. On entering the hospital, after introducing himself, he asked to be taken to the surgical wards, where he most carefully examined every case to be under his charge. Not being occupied, I followed them through the ward, not knowing him, but being greatly impressed by his strong personality, and, on inquiring later who the gentleman was, I was not a little surprised to learn that it was the newly elected professor of surgery, Dr. Ashhurst. A few days later I had the pleasure and privilege of administering ether for him during an operation, and here was laid in a small way the foundation of a friendship which continued deepening and widening until Dr. Ashhurst's death. I well remember his first clinic. It was rich in surgical material, and lasted well into the afternoon. Paul Miller, a very intelligent nurse, who then had charge of the surgical wards, remarked to Dr. Wharton and me: "Mein Gott! doctor, that professor will kill us; he will operate so much." In those days there were few nurses, and the bulk of the

work of the clinic came on the resident and the head nurse. The surgical clinics were held by Drs. Agnew and Ashhurst—Wednesday being Dr. Agnew's and Saturday Dr. Ashhurst's day for operating. These days soon became recognized by the profession as days when interesting and obscure cases could be sent to the University Clinic, either for an operation or an opinion. Consequently, although the wards were small, they were very rich in surgical operative material. In those days the surgical ward was divided between the surgeons on duty, Dr. Ashhurst having the west side and Dr. Agnew the opposite. This was before the days of antiseptics, but it was from the hands of Dr. Ashhurst that I had my first lesson in surgical cleanliness. In fact, the first thing that he did in taking charge of the ward was to re-dress and cleanse each case with his own hands. This cleansing process was no perfunctory procedure. It began with a liberal use of turpentine, hot water, and soap; was followed by a strong solution of permanganate of potassium, and, lastly, the part was thoroughly washed off with alcohol. We used to speak of it as the polishing process, but, nevertheless, it was astonishing to note what a marked improvement took place under his careful supervision. Dr. Ashhurst's great surgical success depended not primarily on the operation, but upon the great personal care which he gave his cases from the time they came under his supervision until they were discharged. This meant a great deal of laborious work which might have been relegated to his resident, but he felt that patients coming to the hospital expected to procure the best of surgical treatment, and that it was his duty to give them as much of his personal attention as was possible. For a long time he did his own night work, which was considerable in those days, as all the Pennsylvania Railroad accident cases were taken to the University Hospital. I remember sending for him in the small hours of the night to see a head injury, which proved to be not so severe as I had expected. I apologized for bringing him on an unnecessary errand, and he replied that he would much prefer being called out unnecessarily a dozen times than fail to be called once when it was necessary.

Dr. Ashhurst's relation with his residents was particularly pleasant, especially if he had confidence in his house-officer. His rather

dignified and reserved manner was at first a little repellant, but this soon disappeared, and the relationship became that of a warm and lasting friendship. There are few men here who have served in his wards who do not look back upon the term spent under him with both pleasure and profit, feeling that they had a friend and confidant upon whom they could rely for future advice and counsel, of which surely many of us have availed ourselves. He was not a lenient chief, but expected his orders to be promptly carried out, and was rather skeptical about excuses when they were offered the following day for failure in carrying out an order given. A little incident which occurred at the Pennsylvania Hospital was related to me by one of his house-officers—a man for whom he had great respect and confidence. The gentleman in question had been on what is known as the "receive," *e. g.*, taking care of all the cases which came to the receiving ward, which usually meant many calls in the night. Frequently a man's time was so interrupted that the ward dressing suffered, and was often not completed until the afternoon. On this occasion, when Dr. Ashhurst was making his daily visit to the ward, the resident plead that owing to distractions in the receiving ward he had been unable to do his dressing. "Very well, doctor, if you have been so busy I will dress your ward for you." Whereupon he deliberately dressed all the cases in the ward.

Residents before serving under him often complained that he did too much of the routine dressing, etc., but I never heard this complaint made after a few weeks' service, as it was soon recognized how much more instructive was the work when performed by a master-hand and one who was so thoroughly conversant with the art of wound-dressing—an art which, I regret to say, will soon be lost, owing to the popular idea that a piece of sterile gauze is all that is necessary, no matter whether intended for a freshly made wound with neat skin approximation or for a sloughing leg ulcer or a burn. Exceptions were sometimes taken to the fact that he performed all of his major operations himself, and gave none of them to his house-officer. This was so, and was the result of a strong feeling that all operations of a major character should be performed by the surgeon on duty, and not by his assistant. Nevertheless, he felt that certain operations, as amputation of the finger, etc., were

justly due to the resident, but it was distinctly understood by him that the fingers did not extend up to the wrist-joint. I well remember, when a substitute in the University Hospital, a man who had had his hand injured by a circular saw. The case was brought in during Dr. Ashhurst's ward visit. I expected, of course, that he would do the necessary amputating, but, to my surprise, he administered the anæsthetic and informed me that I was to do the amputation. I have mentioned some of the little incidents of Dr. Ashhurst's relations with his residents; I wish now to speak of him as a surgeon, in the sphere in which so many of us knew and respected him. He was profound, knowing his entire subject from its first conception, and thoroughly conversant with it in all its phases. His judgment was as nearly faultless as that of a human being can be, and his opinion was based on a complete recital of all the points in the case. He never jumped at conclusions. Thoroughness was a very prominent feature of his surgical character. I never saw him do anything in a perfunctory way, no matter how trifling or unimportant. The simplest operation was performed with as much care and deliberation as if it were of the greatest character, and it always received its full share of after-treatment. He was particularly honest, both in relation to his patients and to the profession. He inspired confidence in every person with whom he came in contact; he never was a *poseur*, and had the greatest abhorrence for that sort of person. I frequently felt that he often dimmed his own powerful light from casting its more brilliant rays, which it was so capable of doing. His pure honesty of purpose resulted in his having much responsibility, as his advice was sought not only by members of the profession, but by governing boards and committees, on so many of which he served, and it was only a question of a short time after becoming a member of any organization until he became a ruling spirit, due to his honesty of purpose, conscientiousness, and his ability to grasp all sides of the situation, and an earnest desire to work for the best interests, regardless of all personal feeling.

With these characteristics, it is not surprising that he occupied the important positions he did in so many of our governing bodies. In his methods and technique of operation he never attempted brilliancy or rapidity. The strongly marked characteristics of which

I have spoken were again very apparent in his operations. Here care, deliberation, and the careful planning which enabled him to know exactly what he intended to do before he began his operation were marked, not depending, as so many surgeons do, upon what might arise, or upon the suggestions of his assistants. It was usually considered wiser for assistants, if they had opinions of any special procedure, to keep them to themselves. In certain operations Dr. Ashhurst was unquestionably a past master. I know of no person who had such results as he had in his own operations. He did much to bring excision of joints before the profession. His early recognition of the pathology of concussion of the spine and brain has long been recognized and accepted by the profession. His accurate mathematical mind made him, I think, the best operator on deformities of the face where excessive plastic procedures became necessary that I have ever seen. In the operating-room he was very quiet, seldom speaking, cool, fearless, and collected; he was never excited by emergencies, and had absolute control of his temper, so that no matter how trying or annoying the circumstances, he never vented his irritation upon his assistants or nurses. Through many years of association I never received a sharp word, and I have no doubt that many times I deserved it. I think that this statement will be borne out by my friend Dr. Wharton, who was his chief of clinic at the University Hospital during his entire professorship.

As a teacher Dr. Ashhurst could not be otherwise than good, because he was a thorough master of his subject, and this in a very short time became impressed upon his class. His surgical lectures, perhaps, did not appeal so much to the second-course student as they did to the third-year and fourth-year men, because by that time they recognized his thoroughness and accuracy. His object in teaching was that the class might become thoroughly imbued with the great underlying principles of surgery which have stood the test for thousands of years, and I must say that when graduated from under his instructions they did know the principles and many of the practices of surgery. In his lectures he confined himself rather closely to his notes, fearing that he might be led a little aside from his subject, and thus not give the class all of the best in

the hour allotted to him. Dr. Ashhurst was noted for his punctuality—not like some medical professors, who come to their lectures habitually late, and, like Charles Lamb, at the Indian House, leave correspondingly early. He always began on the stroke of the hour, and did not stop until the bell rang. His expression was clear, concise, and free from ambiguity, so that if attention were paid there was little chance for false impressions to be left in the minds of his listeners. His manner was always dignified, and no levity was ever indulged in, no matter what surgical subject was under discussion, which speaks in itself of the great respect in which he was held by his class.

As an examiner he was by many considered severe; but I do not think that ever a man who failed in examination could complain that he did not have sufficient opportunity to retrieve himself after failing in his first few questions. He was always a strong advocate of oral examinations, and believed that it was the truest of man's qualifications. He was sometimes criticised for his delay in accepting the so-called antiseptic method of surgical treatment when first introduced by Mr. Lister, now Lord Lister. This, I think, was in a measure due to the slowness of Mr. Lister to publish the statistics of his results, and as he had an opportunity to compare his own work in the same ward where the Lister treatment was being carried out by his colleagues, especially when carbolic acid played so important a part in the technique. Later, when corrosive sublimate supplanted carbolic acid, and heat played so important a part in the sterilizing process of everything employed in surgery, and the results began to show for themselves, he adopted that method in his surgical work, with the most satisfactory results. Time will not permit me in this short sketch to dwell longer upon purely professional matters.

Dr. Ashhurst was an indefatigable worker, and during the many years of our acquaintance he never took a vacation, except possibly a few days to attend some of his surgical society meetings which were held in some of the Eastern cities. He took great pleasure in his country-place, to which he went early in the summer, returning daily to the city. His greatest pleasures were his hospital ward, his literary work, and the great interest which he took in church

matters, and, lastly, the love which he bore this memorable body, to which he was elected in 1863. He served faithfully on many of her committees, and was finally elected Vice-President in 1895 to 1898, and later was made President in 1898 to 1900, an honor which he regarded as the greatest that can be bestowed upon any member of the profession. The College never had a more loyal or devoted Fellow, or one who had always her best interests more at heart. It is due to such far-seeing, wise, and conservative men that this College occupies the unique position which it does as the oldest and most dignified medical body in America, and corresponding more closely to the Royal College of Surgeons than any other institution in the world. It was always the hope of Dr. Ashhurst, as it is the wish of many of us, that the same conservative spirit shall be maintained which has been so important a factor in making it one of the most representative medical bodies in the world.

Dr. Ashhurst married Sarah Stokes Wayne in 1864, and had seven children, three sons and four daughters. Two of his sons have studied medicine, one practising in Mexico, and the youngest now a resident at the Episcopal Hospital in this city. Dr. Ashhurst, though never a very robust or strong man, was rarely ill, and never missed a lecture at the University from sickness. It was about the end of his term of service in the Pennsylvania Hospital, in July, 1900, during a very heated period, that he had been operating during the afternoon, and, feeling exhausted, had gone to his office, and later in the afternoon took the train for his home in the country. During the night and in his sleep he had a cerebral hemorrhage, causing paralysis of his entire left side, from which he never recovered. His friend and colleague, Dr. Tyson, was sent for, and devotedly attended him through his long and trying illness of almost two years. Few can realize what a trying ordeal this must have been to an active temperament like Dr. Ashhurst's, but it was borne with fortitude and courage, never complaining and always grateful for any little attention shown him. It was during this long and tedious illness that his Christian spirit seemed to rise higher. We can form little conception of how hard it must have been for him to be suddenly incapacitated by this paralysis of his body while his mental faculties were left unimpaired. This was his

trial, and he stood the test bravely. At first, indeed, the love of action rose higher and higher, as though it could not be restrained, but soon a spirit of submission was poured over the troubled waters, and they became calm. Resistance was no longer a protest, but rather an expression of surprise. Nearly two years of waiting, and there was no complaint, no murmur, no element of bitterness or repining in the resignation with which he accepted this trial which had come to him. His faith in the future continued unwavering, and his hope of a blessed life beyond never failed him. He died as he had lived—a *Christian*. At the end his death was very peaceful, his illness lasting but a few hours.

This memoir would indeed be incomplete did I not speak of Dr. Ashhurst as a friend and confidant, a man to whom could be unburdened one's innermost soul and leave his presence benefited by the interview. I well remember that on one occasion I went to him about a very trying and troublesome operation in which I was uncertain whether I had pursued the wisest course. To my great comfort his remark was: "You did what you considered was the wisest and the best at the time, and that is the most anyone can possibly do." Many years have passed since then, and with greater experience and more matured judgment I have recognized the wisdom of his remark.

He was a true and loyal friend in every respect. When he had once accepted a man as a friend he was unwilling to see any fault in him if it could be possibly avoided. Yet, if he was once forced to believe that a man was dishonorable it was difficult to get him to believe any good in that person afterward. He was always loyal to his friends, and they knew exactly in what relation he stood to them. He had the greatest respect for differences of opinion, especially when it was frankly and respectfully expressed. There are many here who can look back on his friendship as one of their most cherished possessions.

In closing, Dr. Ashhurst's mental and moral characteristics may be summed up briefly as follows: From youth he possessed an intense personality. He was fearless, exact, and true. These characteristics he combined with good sense, a wonderful memory, and a rare honesty and sincerity of purpose; abhorrent of shams, judging

men by their inherent worth, and not by externals nor environments. The inestimable influence of such a man for good, and what he has accomplished in his profession and out of it, can only be hinted at in this insufficient sketch. But how much nobler and greater was the *man* himself than all his work, multiform and useful as it was. To know John Ashhurst was to respect him; to secure the privilege of his friendship was to love and revere him with a love and reverence seldom given to mortals to obtain.

MEMOIR OF ALFRED STILLÉ, M.D.

By WILLIAM OSLER, M.D.,
PROFESSOR OF MEDICINE, JOHNS HOPKINS UNIVERSITY.

[Read April 2, 1902.]

I DOUBT not that every Fellow of this College had a feeling of thankfulness, mingled with a sort of pride, that Alfred Stillé was spared so long to grace and adorn our Society. His venerable presence was itself a sort of benediction; his culture a refining influence, and there was about him "a certain niceness of nature, an honest haughtiness and self-esteem," which well became his position and his years.

The College has had Fellows more distinguished—men who have filled a wider space in our annals and who have been more closely identified with her history—but it would be hard to name a Fellow in the past half-century who was more deeply interested in her welfare, more appreciative of her needs, or one upon whom was a richer anointing of the spirit of the fathers.

I feel it a special privilege to be allowed to act as the mouthpiece of my colleagues in expressing our sense of the value of his work and the lessons of his life. The physician of the last century, whose "floruit" came in the fourth, fifth, and sixth decades, is of all men the most to be envied. Coming out of the wilderness in which we had wandered for two thousand years, he entered the promised land, and under the leadership of Laennec and Louis, of Skoda and of Virchow, he saw the heathen dispossessed and the profession at last enter upon a heritage of scientific medicine.

I.

Born in 1815, Dr. Stillé began his lifework with the generation which saw the new pathology and the new clinical methods. To this accident of the time of birth were added favoring social and local surroundings. Like Sir Thomas Browne, he could "lift up one hand to heaven that he was born of honest parents, and that modesty, humility, patience, and veracity lay in the same egg and came into the world with him." With Milton, he could feel that his endowments were happily not the worse for 40° of northern latitude. Among his papers are several interesting autobiographical fragments relating to this period. After joining in the "comic section" rebellion at Yale, which led to the retirement of one-half of the class, he seems to have had for a time a leaning toward the law. "During the years of probation," he says, "I tested the strength of my partiality for a medical career by some medical reading, including Bell's *Anatomy* and Bichat's *General Anatomy*, and attending the anatomical instruction at the Jefferson Medical College. In this last I was joined by my friend Mandeville, who was at that time already a student of law. I was induced to pursue these anatomical studies at the Jefferson College by Dr. George McClellan, who was then attending my sister Sarah for a tedious ailment, and also by the reputation of the professor of anatomy in that institution, Dr. Granville Sharpe Pattison. He was certainly a most eloquent teacher, and he made the dry subject interesting by mixing with pure anatomy a good deal of physiology and surgery, and even a dash of poetry. I shall never forget his lecture upon the skull, in which he recited with admirable feeling the famous lines of Byron beginning, 'Is this a palace where a god might dwell?' Indeed, the charm of Pattison's lectures was his enthusiasm, tempered and guided by cultivation. His voice was flexible and sonorous, though not loud, and his manner intensely earnest, but never violent. While I attended his lectures I also began the study of practical anatomy in the new and admirably constructed dissecting-room of the same college, and pursued it with much enthusiasm in company with Mandeville."

The best of luck awaited him when, in 1835-36, he became house physician at "Blockley," under W. W. Gerhard, a clinical teacher of the very first rank, and fresh from the wards of the great French physician, Louis.

He was much indebted, too, to Pennock, of whom he has left the following appreciative sketch: "Meanwhile, I studied physical exploration and diagnosis with Dr. Pennock, who, besides having been associated with Dr. Gerhard in his fever studies, also devoted himself especially to diseases of the heart. I had assisted him in or been present at some of the experiments on sheep which he performed to demonstrate the mechanism of the heart's action, and now at the hospital I was instructed by him in the clinical diagnosis of heart disease by physical methods. He was a man who united with a rare enthusiasm in the study of the heart's functions and diseases—and, indeed, in whatever he undertook—a transparent honesty and innocency of character and a generous ardor of benevolence that made him beloved as well as admired. He was in nearly all respects in contrast with his friend Gerhard, who was frequently satirical, devoid of sentiment or imagination, and equally so of strong personal attachments. No doubt Gerhard was the more intellectual man, but Pennock was the nobler of the two. His chief contribution to medical literature, besides his collaboration with Gerhard in the essay on *Typhus*, was an edition of Hope's *Treatise on the Heart*, to which he added much that was valuable, including the experiments performed by Moore and himself. It is remarkable that both of these men were arrested in their professional career not by death, but disease; for about 1850 Gerhard suffered from disease within the cranium, which, although it did not render him a paralytic or an imbecile, extinguished every spark of his ambition and caused a permanent halt in his acquisition of knowledge. He repeated over and over again his old lectures, but added to them nothing new. In 1863 he did, indeed, record his observations of epidemic meningitis; but this was, I think, the only occasion of his revival."

In remarks made at the dinner given on the occasion of his retirement from the Chair of Medicine, Dr. Stillé referred to his

two teachers in the following words: "While still a medical student two of my fellow-townsmen returned from abroad glowing with the fire they had caught in Paris, the then acknowledged centre of medical science. Gerhard and Pennock were the apostles of the school of observation, under whose preaching I became a zealous convert. As soon as it was possible I hastened to the enchanted scene of their European labors."

I have written much and talked more on the subject of Louis and his band of American pupils, of whom Stillé was a good representative. The mantle of Laennec fell upon Louis, who seems to have had in singular measure the gift of inspiring enthusiasm in his students and a touching personal devotion. No European teacher has ever appreciated more highly his transatlantic pupils, and not one has ever had a more distinguished band of followers. Oliver Wendell Holmes said that he had learned three things in Paris: "Not to take authority when I can have facts, not to guess when I can know, and not to think a man must take physic because he is sick." It seems to me that this group of young fellows brought back from Paris, first, an appreciation of the value of method and accuracy in the study of the phenomena of disease; secondly, a profound, and at the time a much needed, distrust of drugs; and, thirdly, a Gallic refinement and culture which stamped them, one and all, as unusual men. Let me name the list over as given to me by Stillé himself: "From Boston: James Jackson, Jr., H. I. Bowditch, O. W. Holmes, George C. Shattuck, Jr., John C. Warren (then past middle age), John Mason Warren, and John D. Fisher. From Philadelphia: George W. Norris, William W. Gerhard, Caspar W. Pennock, Thomas Stewardson, Alfred Stillé, Thomas L. Mütter, E. Campbell Stewart, Charles Bell Gibson, John B. Biddle, David H. Tucker. Baltimore: William Power (see biography of Charles Frick, in Gross' *Lives*). Charleston: G. S. Gibbes, Peter C. Gaillard, Peyre Porcher. Virginia: J. L. Cabell, L. S. Joynes, —— Randolph. New York: John A. Swett, Abraham Dubois, Alonzo Clark, Charles L. Mitchell, —— Punnet, Charles D. Smith, Valentine Mott, Sr. In addition, Edward Peace, Mere-

dith Clymer, William P. Johnston, W. S. W. Ruschenberger, and John T. Metcalf." There were many others, of course—some before Louis' day, as Samuel G. Morton, who was Laennec's most distinguished American pupil, and some of those mentioned, as Meredith Clymer (*ultimus Romanorum*[1]) and Metcalf, just gone, who did not come so directly under Louis' influence, but were pupils of Chomel and Andral.

II.

Method and accuracy were from the first characteristic of Dr. Stillé's work. He played an interesting part in that splendid contribution of American medicine to the differentiation of typhus and typhoid fever. I will let him tell the story in his own words. In a manuscript he says: "The year 1836 is memorable for an epidemic of typhus (t. petechialis) which prevailed in the district of the city which is the usual seat of epidemics caused or aggravated by crowding, viz., south of Spruce and between Fourth and Tenth Streets. A great many of the poor creatures living in that overcrowded region and who were attacked with typhus were brought to the Philadelphia Hospital, where I had charge of one of the wards assigned to them. I had the great good fortune to study these cases under Dr. Gerhard. His permanent reputation rests upon the papers published by him in Hays' *Journal*, in which he fully established the essential differences between this disease and typhoid fever. All the original material he obtained in this country for determining the symptomatology of typhus was gathered by him during this epidemic; but his first studies of the disease had been made in Great Britain. The contrasted picture of typhoid fever was composed of the features he had become familiar with while studying that disease as a favored pupil of Louis, in Paris, so that he may be said to have been the first to meet the two diseases face to face, with a full acquaintance with one of them and a daily increasing knowledge of the other. On

[1] Died April 20, 1902.

a small scale I went through the same experience, for I had grown familiar with typhoid fever while following Gerhard's clinical instructions in the Pennsylvania Hospital the year before, and at every step of my study of typhus in the wards and post-mortem revealed new contrasts between the two diseases, so that I felt surprised that the British physicians should have continued to confound them. I was very diligent in making clinical notes and dissections, spending many hours every day in the presence of the disease. I, however, escaped its contagion, while several others of the resident physicians suffered attacks of it, one of which, I think, ended fatally. I look upon that arduous and even dangerous experience as one of my most valuable clinical lessons." In the draft of a letter dated February, 1862, found among his papers, entitled *Refutation of A. F. Stewart's Claims about Typhus and Typhoid Fevers*, there is the following account: "It is known that the question had already been conclusively solved by Drs. Pennock and Gerhard, of Philadelphia, in 1837, whose essay upon it was published in the February and August numbers for that year of the *American Journal of the Medical Sciences*, republished in the *Dublin Journal of Medical Science*, September, 1837, p. 148, analyzed in the *London Medico-Chirurgical Review* for October, 1837, p. 553, and translated in a Parisian medical journal, *l'Experience*, in 1838. The writer of the present communication, having had the advantage of observing the typhus epidemic in the Blockley Hospital under the physicians just named, afterward made a special study of typhoid fever in the wards of M. Louis, in Paris, and had opportunities of observing typhus with Vulpes in Naples, Tweedie in London, Alison in Edinburgh, and Graves in Dublin. The results of these observations were contained in a paper, of which Valleix speaks as follows: 'In an unpublished memoir of Dr. Stillé, an interne of Dr. Gerhard during the prevalence of the epidemic in Philadelphia, which was read before the Medical Society of Observation (September 14 and 28, 1838), and which we have before us, the two diseases are compared, symptom by symptom and lesion by lesion; and, apart from the phenomena of fever common to all

febrile affections, the opposite of what is observed in the one is sure to be presented in the other' (*Arch. gen.*, February, 1839, p. 213). Among other conclusions reached by Valleix is the following: 'English and American typhus is a different disease from typhoid fever.' A few months later (*Arch. gen.*, October, 1839, p. 25 and p. 129) the same physician published an analysis of thirteen cases of typhus observed in London by Dr. G. C. Shattuck, of Boston, fully confirming the conclusion just stated. A paper founded on the same cases is also contained in the *Philadelphia Medical Examiner* for February, 1840, p. 133. It was after the whole of these publications—viz., in April, 1840—that Dr. Stewart first communicated his observations to the Parisian Medical Society, and they were not published until October of the same year. His apparent want of candor, therefore, in the paragraph above quoted from his communication to the *Times and Gazette* is, for his own sake, very much to be regretted." I am fortunately able to show you the manuscript of Dr. Stillé's paper, which, with that of Shattuck, made a strong impression on the French physicians, who still clung to the view that there was but one disease. It is a pity that this admirable paper has never been printed. A casual glance over the headings will give you an idea of the fulness and accuracy with which these able young fellows had worked out the differences between these two great diseases. Gerhard and Pennock, Stillé and Shattuck, appear to have been the first to fully grasp their essential clinical distinctions, and to appreciate their merit one has only to read the British writings on fever at this period. Some years later A. F. Stewart did good work in the same line, and later still Jenner made his important study; but that in the first edition of Bartlett on *Fevers*, 1842, the two diseases should have been considered apart is the best testimony to the rapidity with which the new views were received in this country.

Between two and three years of study in Europe gave Dr. Stillé a fine training for his lifework. Returning to Philadelphia, he began practice, wrote for the journals, taught students, and gradually there came to him reputation and recognition. After lectur-

ing on pathology and the practice of medicine in the Philadelphia Association for Medical Instruction he was elected, in 1854, to the Chair of Practice in the Pennsylvania Medical College. In 1864 he succeeded Dr. Pepper (Primus) in the Chair of Medicine at the University of Pennsylvania. While always a student, he was no hermit, but from the start took a deep interest in the general welfare of the profession. He was the first Secretary of the American Medical Association, and President in 1867. The local societies recognized his work and worth, and he became President of the Pathological and of the County Medical Societies, and in 1885 he took the Chair of our ancient and honorable body. He was from the outset of his career a strong advocate for higher medical education, and from 1846—the date of his first address on the subject—to 1897—the date of his last—he pleaded for better preliminary training and for longer sessions. No one rejoiced more in the new departure of the University in 1876, and he was a consistent advocate of advanced methods of teaching.

Dr. Stillé's medical writings show on every page the influence of his great master. His first important work, *The Elements of General Pathology*, 1848, was based on the modern researches, and every chapter echoed with his favorite motto, *Tota ars medica est in observationibus.* I must quote one sentence from the *Introductory Essay on Medical Truth:* "But we assert that there is a genius, not a speculative, not a poetical, not a mere fantastic faculty, but a practical genius, which is, to say the least, a far more rare endowment than that just mentioned; 'a power which is capable of penetrating into all things *within our reach and knowledge* and of distinguishing their essential differences.' It creates nothing, it does not even invent anything; it only *sees things as they are* and discovers truth in what it sees; for the truth, as we are told by Rousseau, is in things and not in our minds, and the less of ourselves we introduce into our judgments the nearer we shall approach to truth. Such was the genius of Hippocrates, of Sydenham, of Morgagni, of Haller, of Laennec, of Abercrombie, of Hunter, of Bichat, of Sir Astley Cooper; such is that of Andral, of Chomel, of Louis, of Cruveilhier, of Brodie,

of Graves. These men saw relations among the phenomena of disease which were invisible to less gifted men; and having seen them by virtue of their genius they did not stop there and build up a theory upon them, assuming them to be true, but immediately applied themselves to discover *whether they had seen correctly;* they tested their inspirations by observation and experiment, and when they found them unable to bear these tests they rejected them as delusions, as idle dreams not even worth remembering; but when, on the other hand, they found them confirmed, they gave credit, not to the original penetration which had guessed at the truth, but to the series of facts which had established it."

Apart from numerous smaller articles in the journals there are two important monographs by Dr. Stillé—one on *Cerebro-spinal Meningitis* and the other on *Cholera.* In addition, two minor studies were on *Dysentery,* in the publications of the United States Sanitary Commission, and on *Erysipelas.* The work on cerebro-spinal fever is a model of accurate, systematic study based on a large series of cases seen in the Philadelphia Hospital, and upon an exhaustive analysis of the literature. The work on cholera is of the same kind. To a generation of lesser writers they have served as unfailing sources of trustworthy information.

Estimated by bulk, the most important of Dr. Stillé's works are the *Materia Medica and Therapeutics* and the *National Dispensatory.* It was always a mystery to me how a man with his training and type of mind could have undertaken such colossal and, one would have thought, uncongenial tasks. He was not so deeply imbued with skepticism as some of his contemporaries. Of him it could scarcely have been said, as of Jacob Bigelow by Professor Peabody, that his qualifications to teach therapeutics were on a par with those of a learned Mohammedan to teach Christian exegesis. Dr. Stillé's attitude on the question of therapeutics was very sane. In illustration, let me quote one or two sentences. "Of therapeutics we may say what has been said of the legislative powers of a State. We cannot assign definite and immutable limits to them or lay down inflexible rules for their use. The treatment of every case of sickness must be determined ulti-

mately for and by itself, tentatively by skilled men and as their practical sagacity may determine, while they bear in mind that the virtues of a medicine depend less upon its intrinsic properties and powers than on the sagacity of the physician who administers it, just as the efficiency of fire-arms depends less upon the explosives and the missile they contain than on the judgment and accuracy of aim of the man who discharges them." He had grasped the great truth that the art as an art had its true and only foundation in clinical medicine. In his Valedictory Address, 1884, he said: "I have devoted whatever knowledge and skill I possessed to the simple, if difficult, task of knowing and curing diseases. I have striven, in season and perhaps out of season, to impress upon you that medicine is, first of all, an art, but an art that can only be successfully practised when the physician is able to recognize the individual diseases he must meet with in practice, and distinguish from one another those which are similar in appearance, but unlike in nature." Again: "But every observant practitioner knows that he treats patients rather than diseases. He does not regard the former as the chemist does his crucibles, retorts, and test-glasses, which have no reaction upon their contents, but he knows that every substance taken into the body acts upon and is itself acted upon by it, and in innumerable modes and degrees, according to the existing condition of the body and the quantity, combination, and form of administration of the medicine; so that there is some ground for the sarcastic comment that 'the art of medicine consists in introducing a body of which we know little into another of which we know still less.'" And yet again: "It is quite as necessary for the physician to know when to abstain from the use of medicine as it is for him to prescribe when medication is necessary; that he must, as far as possible, see the end of a disease from its beginning; that he must never forget that medical art has a far higher range and aim than the prescription of drugs or even of food and hygienic means; and that when neither of these avails to ward off the fatal ending, it is still no small portion of his art to rid his patient's path of thorns if he cannot make it bloom with roses."

III.

On the roll of our Fellows will be found the names of at least half a dozen distinguished bibliophiles to whom we are deeply indebted, as they have kept alive in this society the interest of the average Fellow in books, and have made possible a great library. Dr. Stillé was not only a book-lover, but a discriminating and learned student. Our shelves testify not less to his liberality than to his taste for rare and important monographs, while the Stillé Library of the University of Pennsylvania will remain a monument to his love of the literature and history of our profession.

But it was neither as a teacher nor as a writer that Dr. Alfred Stillé's influence was most deeply felt. In a long career several generations of students and physicians were influenced by an earnest, real man, whose life was true and sincere, whose ideals were lofty, and whose devotion to duty came from pure and unselfish motives. "A life of probity, a high sense of honor, uniform courtesy," as Dr. Da Costa remarked, endeared him to the profession and crowned his declining years with all the things which should accompany old age. Nothing in his life, which was one calling for courage of a high order, became him more than the graceful way in which he grew old. So far as I know, the chapter on the old man in the profession has not yet been written. To-day, as in the sixteenth century, the bitter *mot* of Rabelais is true: "There be more old drunkards than old physicians." Take the list of Fellows of our College, look over the names and dates of graduation of the practitioners of this city, and the men above seventy years of age form, indeed, a small remnant. All the more reason that we should cherish and reverence them. It interested me greatly in Dr. Stillé, and I only knew him after he had passed his seventieth year, to note the keenness of his mind on all questions relating to medicine. He had none of those unpleasant senile vagaries, the chief characteristic of which is an intense passion for opposition to everything that is new. He had that delightful equanimity and serenity of mind which is one of the

most blessed accompaniments of old age. He had none of those irritating features of the old doctor, who, having crawled out of the stream about his fortieth year, sits on the bank, croaking of misfortunes to come, and, with less truth than tongue, lamenting the days that have gone and the men of the past. He was not like the sage of Agrigentum, of whom Matthew Arnold sings:

> "Whose mind was fed on other food, was train'd
> By other rules than are in vogue to-day;
> Whose habit of thought is fix'd, who will not change
> But, in a world he loves not, must subsist
> In ceaseless opposition."

From this unhappy attitude of mind he was saved by a serene faith in the future of the profession. Naturally he did not approve of much that is unpleasant in our modern ways. In some of his last letters there is a touch of the old vigor with which he was wont to rap the pretensions of the ignorant or the half-educated. In a letter to me dated February 7, 1900, he writes: "I never supposed the Louis methods would be accepted by the profession generally. They were too laborious, and they gratified too little the thirst for popular applause and personal exaltation that contaminates so many, even men of merit. Not even their adoption and illustration by a certain number of physicians who drew their inspiration from the Parisian fount has sufficed to prevent their being overwhelmed by the deluge of German speculation on pathology and therapeutics." And again, in the last letter I had from him, June 27, 1900, referring to Bartlett's sketch of Hippocrates, which he says "I read and enjoyed, as I do whatever helps to strip Truth of her gauds and present her in her native simplicity. It seems inseparable from all progress in knowledge that it shall not be administered in too concentrated a form, lest it produce repugnance and indigestion. This has been found necessary in religion, and how could philosophy escape it? Our medical principles and doctrines are found insipid by the vulgar unless they are confectioned to suit the popular palate, with a large seasoning of human invention."

Not the least important service of Dr. Stillé was his persistent emphasis on lofty professional ideals, of which his own life was in reality the best exemplar; for, to use his own words, he was loyal to science and truth, loyal to his art, loyal to the history and traditions of his profession, loyal to the principles and precepts which the peculiar relations of medical men to one another, to the public, and to their patients impose upon them. On the occasion of the dinner given to him in 1884, Dr. Stillé told an interesting incident, which I quote here as his *credo:* "During one of my summer holidays, while abroad, it was my lot—less vulgar then than now—to climb the Alps and observe the expedients used by the mountaineers in ascending the icy peaks. I noted the laborious industry with which they cut for themselves footholds on the slippery steep, and so mounted slowly to their destination. This method profoundly impressed me at the time, and I said to myself: 'Surely in such wise must one hew his way to fame and fortune; and whether the point to be attained be the highest peak of all, or only some humbler hill-top by the way, it was clear that whatever else might win, *improbus labor omnia vincit.*' What seemed revealed to me then among the sublime solitudes of nature has been echoed by a thousand voices along the whole pathway of my life. It came to me also, like a voice from the tomb, in the words of an old family motto, *Innocenter, patienter, constanter*, and it was repeated in the history of all the men I have known who secured for themselves a steadfast place in their day and generation. I cannot doubt that in the bosom of everyone who hears my voice there is felt a silent attestation of its truth. It has been the keynote of my teaching as well as the guide of my actions, and, therefore, how little soever of the good that has been attributed to me by your partial voices may in reality be mine, I owe it all to the lessons of steady industry and undaunted perseverance that I learned from the Alpine mountaineer."

Among his papers is a most interesting and touching letter of advice to his brother Moreton, whose brilliant career was cut short in his thirty-third year. I cannot refrain from quoting the concluding sentences, which express admirably his relations to his

students and his general attitude toward the profession he loved: "It would be useless for me at this time to go into a more detailed development of the system of instruction I wish you to follow. It will be gradually unfolded as you advance, and may be modified by circumstances; and in all your intercourse with me I wish you to look upon me merely as an older student than yourself, who, having trod the same path, has a greater knowledge of its difficulties, and pleasures, and dangers; who will be proud to be your guide, and glory in inspiring you with an ardent love of the profession you have chosen. I feel deeply impressed with the belief that your character and talents are such as eminently to qualify you for attaining distinction as a medical philosopher and gaining the respect and affection of those among your fellow-men who may require your professional services. I will not conceal from you that there is much before you to make even a strong resolution waver. You must toil for years to fit you for the guardianship of the health and lives of men; and yet again you must toil, long and diligently, to reap the reward of your labor. But if you have a spark of benevolence in your heart; if you have that only ambition which is not a vice—to excel others in doing good; if you think that the gratitude and the affection of those you may relieve from sickness is a sufficient recompense for much self-denial and self-sacrifice, then you will not be disappointed. You will be richly repaid for your days of labor and your nights of watching; you will learn to cultivate a spirit of charity toward others, and of justice toward yourself, which will make your station in life respectable and your social and domestic relations hallowed by the light of an unbroken peace." Hear the conclusion of the whole matter—the lesson of a long and good life. It is contained in a sentence of his Valedictory Address: "*Only two things are essential, to live uprightly and to be wisely industrious.*"

MEMOIR OF WILLIAM FISHER NORRIS, M.D.

By GEORGE C. HARLAN, M.D.

[Read June 4, 1902.]

On the 18th of November last the College and the profession met with a serious loss in the death of Dr. William F. Norris. Dr. Norris had been ill for several weeks with recurrent attacks of pneumonia, to which, after frequent alternations of hope and fear on the part of his family and friends, he finally succumbed. Though he had had the objective symptoms of diabetes for more than a year, the disease was held in check by a regulated diet, and he did not seem to his friends to be seriously out of health, but commenced the autumn work in lecture-room, hospitals, and office with his usual industry and faithfulness, and apparently with his usual vigor. There seemed good reason to hope that we might long continue to enjoy the helpfulness of his professional work and the pleasure of his personal friendship, but that hope was doomed to disappointment, and we are called upon to deplore his loss.

Dr. Norris was the son of the distinguished surgeon Dr. George W. Norris, and was born in Philadelphia on January 6, 1839. He came of a family that has been prominent in the community for many generations. Its origin is traced to the Isle of Wight. Thomas Norris, the earliest member of the family of whom accounts are preserved, was a merchant in London in 1650. He joined the Quakers, and in consequence suffered persecution, which finally drove him from the country, and he settled in Jamaica. He and all of his family, with one exception, perished in the earthquake which destroyed Port Royal in 1692. His son Isaac, who chanced to be absent on a visit to Pennsylvania at the time of the catas-

trophe, escaped the fate of the rest of the family, and, abandoning Jamaica, removed to Philadelphia. Isaac Norris engaged successfully in mercantile pursuits, trading with the West Indies and England, and was soon able not only to make good the financial losses sustained in Jamaica, but to acquire a considerable fortune. He lived in a large country house in the suburbs known as Fairhill, and purchased from the Penn family an estate of 7000 acres in what is now Montgomery County. This tract now forms the township of Norriton, and includes Norristown within its limits. The maiden name of Dr. Norris' mother, who also belonged to a well-known family, was Mary P. Fisher.[1]

After preparation for college in Ferris' school, where many Philadelphia boys of the time received their preliminary education, Dr. Norris entered the collegiate department of the University of Pennsylvania, graduating with the class of 1857, and received his medical diploma from the same institution in 1861. During the same year he was elected a resident physician of the Pennsylvania Hospital, and served a full term of eighteen months. Soon after leaving the hospital he entered the United States Army as assistant surgeon, and served in that capacity until October, 1865, when he resigned with the brevet rank of captain, conferred upon him for "faithful and meritorious services during the war."

He was placed in charge of the Douglas Hospital, in Washington, and remained in that position during his connection with the army. In addition to his official duties and numerous scientific contributions to the Army Medical Museum, he, in connection with Dr. William Thompson, who preceded him in charge of the hospital, spent much time in the development of photography as a means of recording the appearances of wounds and diseases, and in experiments in microscopic photography. These studies in optics were the beginnings of his interest in that special work to which his subsequent life was devoted with such faithfulness and success.

On his return to civil life he decided to pursue his studies abroad, and sailed for Europe in the autumn of 1865. He visited all of the large ophthalmological clinics, but spent most of his time in Vienna, chiefly under the instruction of Arlt, Jaeger, and Mauthner. He

[1] From Dr. William Hunt's memoir of Dr. Norris' father.

also worked in the Pathological Institute, and in conjunction with Stricker carried on exhaustive studies in the histology and pathology of the cornea. At this time, as always, he was an industrious and conscientious student, and allowed no opportunity of increasing his knowledge to escape him. His friend and fellow-student, Dr. Richard Derby, of New York, has kindly sent me the following memorandum of his life in Vienna:

"During the winter of 1868–69, in Vienna, I was constantly with Dr. William F. Norris. We had prevailed upon Professor Arlt to give again his famous course in operative surgery of the eye, and had found among the American students at the Cliniques of the 'Allgemeine Krankenhaus' six or eight others than ourselves who were anxious to profit by this instruction. Not content with the operations that we here performed upon the eyes of pigs, Dr. Norris and I made arrangements with the janitor of Billroth's Surgical Clinique, by which every morning at as early an hour as 7 o'clock we went to the dissecting-room attached to this clinique, there to find a freshly decapitated human head placed upon a block, and on the human eye we, in turn, practised tenotomies, iridectomies, and operations upon the tear passages. How many months this lasted I cannot now say, but I do recall that we paid for something more than one hundred heads.

"As I recall Norris at this time, he was a singularly handsome man, with a long blond beard, a kindly blue eye, and a pleasant smile, somewhat diffident with strangers, but frank and open with his friends, and skilful with his hand. He reminded me of some of the pictures I have seen of the anatomist Vesalius. He was much engaged with anatomical and microscopic work in the laboratory of Stricker, and, if I am not mistaken, was then making extended studies in inflammation of the cornea. He was busy with his work, and was rarely seen with the other students of our medical colony in the evening. It was about this time that he met the lady whom he afterward married, and I well remember the surprise that Professor Arlt expressed to me when he heard that Norris was actually engaged to be married, and that he had been able long enough to lay aside the serious work of his life to conduct a courtship."

Specialism, which had heretofore been looked upon with suspicion by conservative Philadelphia, had been made respectable by the stand taken by Dyer, Strawbridge, and Thomson, who were clearing the way for the rapid advance since made by ophthalmology, while Mitchell was impressing upon the profession the importance of eye-strain as a cause of reflex nervous disturbance when Dr. Norris returned from Europe in 1870. He joined the thin ranks of ophthalmic surgeons, and by his position in the profession and in the community, and by his thorough preparation and persistent industry, soon gained the position of an acknowledged leader, which he retained throughout the rest of his life. Up to this time ophthalmology, if not entirely ignored in the lecture courses, was taught in such a casual and incidental way that it was quite possible for a fairly good student to graduate without being able to differentiate between corneal leucoma and cataract, and to be pretty sure to diagnose glaucoma as neuralgia; but the subject was now compelling recognition, and the first indication of this fact at the University was the appointment of Drs. Norris and Strawbridge as lecturers on diseases of the eye and ear. Three years later—1873—ophthalmology was further specialized by the appointment of Norris as Clinical Professor of Diseases of the Eye, while Strawbridge was given a corresponding position in otology. Later Dr. Norris was made honorary professor, and finally, in 1876, a full professorship of ophthalmology was evolved, and he was appointed to fill it.

Dr. Risley, who served as Dr. Norris' assistant for eighteen years, has given me the following note of his teaching at the University in those early days: "In the spring of 1872, Dr. Norris requested me to join him in his work at the Eye Clinic of the University, then at Ninth and Chestnut Streets. We worked there, with other assistants, until the clinic was removed to the new University Hospital in West Philadelphia. Here he appointed, I think in the order named, from time to time in the following years, Dr. Piersol, now Professor of Anatomy in the University; Dr. Shakespeare, too soon lost to science; Dr. Randall, Dr. Wallace, Dr. de Schweinitz, Dr. Oram Ring, and Dr. John T. Carpenter. Later Dr. Mellor was appointed after I left the clinic in 1890. I shall never forget his early lectures in the old amphitheatre at Ninth and Chestnut Streets—his

extreme diffidence, not to say embarrassment, in first appearing before the class in those days. But his wise and careful teaching; his earnest search for the truth; his great respect, amounting almost to a feeling of reverence, for his great European teachers whom he had so recently left, were but the commencement of his career as an ophthalmologist, and fairly foreshadowed the long years of earnest, faithful, and helpful service which he rendered—a great service not only to the afflicted whom he sought so earnestly to relieve, but to those of us who were privileged to labor with him and to come into the sphere of his stimulating influence and helpful personality. I cannot overestimate the deep respect which we, his assistants, all had for him and for his teachings. I think it was quite natural for us all to either actually defer to his opinion in any given case of disease, or to mentally refer the matter to him for his views by habitually asking one's self the question as to what he would think or order under such conditions."

To this list of his assistants must be added the names of Dr. Charles A. Oliver and Dr. William Zentmayer, who served in that capacity at the Wills Eye Hospital, each for a period of eleven years. Indeed, when we remember his teaching, and writing, and hospital work, and his personal and professional influence, but particularly the men whom he trained, and who, successfully carrying on the work on lines laid down by him, have maintained a high scientific and ethical standard for their specialty, we may almost consider Dr. Norris the father of modern ophthalmology in Philadelphia.

Perhaps the most important of Dr. Norris' work for advancing the medical interests of Philadelphia was in connection with the University Hospital. He was one of its originators; in fact, the project was launched by the appointment of a committee of the Alumni Society of the Medical Department on a motion made by him. He was a member of the Finance Committee, of which the indefatigable Pepper was chairman, and subsequently became President of its Board of Managers. To the last his devotion to its interests and his readiness to work for it never flagged. The last time I saw him, only a few days before his death, he spoke of it with affectionate interest, and expressed the hope that he might soon be well enough to go back to his work there.

The following resolutions passed by his fellow Trustees show the estimation in which he was held by them:

"WHEREAS, The Board of Managers of the Hospital of the University of Pennsylvania has been bereft by death of its distinguished President, Dr. William F. Norris;

"*Resolved*, That the board has lost a colleague who, as one of the founders of our splendid hospital, gave of his knowledge and experience, time, and private means in the erection of the building, and when the structure was an accomplished fact continued as a member of its Board of Managers his earnest and unceasing efforts in assuring its equipment, maintenance, extension, and improvement; that as President of the Board for the last nine years, his successful administration, beset with difficulties, has been marked by foresight, patience, and a conscientious attention to duty; that we mourn a friend who, while he excited our admiration by his wisdom and energy, endeared himself to us by his gentleness and courtesy."

When the Wills Eye Hospital was reorganized under the Board of City Trusts, in 1870, Dr. Norris was appointed to a position on the surgical staff. It was there that I was first brought into intimate association with him and learned to appreciate his worth. We worked together for more than thirty years, and our constant consultations in every case of interest or importance were both pleasant and profitable, and are among the most precious reminiscences of my professional life. He was always thorough in diagnosis, careful and conscientious in treatment, and just and courteous to all with whom he was brought in contact, and won the respect of everyone connected with the institution, from the Trustees and surgeons to the humblest patient in the wards, who was as sure of his best efforts as was the most important of his private patients. He operated with good judgment and a firm hand, and always with care and caution, entirely with reference to the interest of the patient, and without any attempt at display or a thought of the impression that he might produce on those about him. He was thought by some to be unduly deliberate. Certainly, he was thorough rather than quick. The fact is that time was no object compared with correctness of decision and precision of action, and whatever he undertook was sure to be

well done, however much time it might take to do it. He was considered conservative, as he hesitated to abandon any long-tried procedure until convinced that change would mean improvement. Thus he declined for some time to perform simple extraction of cataract, but when once assured that it was the better operation performed it always afterward except in complicated cases.

As an author Dr. Norris' reputation was international. Besides many communications to societies and articles in medical journals, he made a number of contributions to ophthalmology that may be considered classical. Among these are his carefully prepared and exhaustive article on "Albuminuric Retinitis," in Dr. Tyson's monograph on *Bright's Disease;* an excellent chapter on "Medical Ophthalmology," in the *System of Practical Medicine* edited by Pepper; a *Text-book of Ophthalmology*, written in conjunction with Dr. Charles A. Oliver; and a *System of Diseases of the Eye, by American and Foreign Authors*, edited also in collaboration with Dr. Oliver. This last is the most elaborate work on ophthalmology in the English language, and is a monument to the knowledge and industry of its editors. Dr. Norris' personal contribution to this *System* was an article on "Diseases of the Crystalline Lens," prepared with his usual literary ability and care.

His original work is included chiefly in experiments in microphotography in Washington, with Thomson; the Versuche ueber Hornhautentzündung with Professor Stricker in Vienna; "Investigations of Double Staining in Microscopic Work," with Shakespeare; "A Description of the Anatomy of the Human Retina, with Special Consideration of the Terminal Loops of the Rods and Cones," with Wallace; and studies of the lens in the article in the *System of Diseases of the Eye.* He wrote clearly and distinctly, without redundancy of words, and always "as if he had something to say rather than as if he had to say something."

Dr. Norris became a member of the American Ophthalmological Society in 1870, and was elected its President in 1884. He was an excellent presiding officer, dignified, just, and prompt, and without a trace of the diffidence that was sometimes noticeable in his association with strangers or in appearing before an audience. He was elected a member of this College in 1866, and although too busy to

be a regular attendant at its meetings, always felt a lively interest in its welfare, and served as one of its censors for nearly ten years. He took an active part in the establishment of the Ophthalmological Section, drew up the regulations for its government, was its first chairman, and subsequently chairman of the Executive Committee, always doing his share of the scientific work of the meetings and interesting others to do likewise. The origin and success of the Section were largely due to his efforts in its behalf.

Dr. Norris had served in office as Assistant Surgeon, United States Army; President of the American Ophthalmological Society; Chairman of the Ophthalmological Section of the College; one of the Censors of the College; Vice-President of the Philadelphia Pathological Society; Ophthalmologist to the University Hospital; President of the Board of Trustees of the University Hospital, and Professor of Ophthalmology in the University. He was also for many years Attending Surgeon and afterward Consulting Surgeon to Wills Eye Hospital; a member of the Academy of Natural Sciences; companion in the Military Order of the Loyal Legion; member of the American Philosophical Society, and Director of the Mutual Assurance Company (the "Old Green Tree").

During his student days in Vienna Dr. Norris became interested in a beautiful German girl, Fraulein Rosa Clara Bachman, and three years later returned to Vienna and brought her to his Philadelphia home as his wife. They had three children, all sons. The youngest died when about five years old. Of the survivors, one—Dr. George W. Norris—has just completed a term as resident physician in the Pennsylvania Hospital, and the other—William Felix Norris—is a student in the law department of the University. In his home life Dr. Norris was a model of kindness, gentleness, and unselfishness, making companions of his boys and caring for his wife through a painful and trying illness, prolonged for years, with unremitting devotion. Mrs. Norris died about five years ago, and in 1899 Dr. Norris married Miss Annetta C. Earnshaw, of Gettysburg, Pa., who survives him.

Dr. Norris' hobby was Woodbourne, his beautiful farm of several hundred acres in the mountains of Susquehanna county, near

Montrose. Here he sought rest and recreation after the winter's work; and he was never happier than when salting his cattle in the pastures, breaking his colts, wandering, pruning shears in hand, among his fruit trees or superintending the cultivation of his flowers. Of these he had an unusually fine collection. It was his ambition to cultivate everything that the soil and climate of the region would sustain, and he was much amused that some of his utilitarian farmer neighbors were disposed to look upon him with disapproval as a dilettante sort of person who wasted time and money in "raising posies." His time, however, was by no means given up to rest and pleasure entirely, for even here there was work to be done, and a part of each day was devoted to preparing manuscript or correcting proof. In this happy retreat his friends were welcomed with a delightful hospitality which will be a lifelong pleasant remembrance for all who have enjoyed it.

Dr. Norris had no time and little inclination for general society; was, indeed, somewhat shy and reserved with strangers, but enjoyed the company of congenial friends. His pet dissipations were the "Green Tree" dinners and the suppers of the Medical Club. He was a member of the latter for nearly thirty years. He never allowed anything but illness to prevent his attendance, and was always one of the last to say good-night. His gentleness and courtesy and his warm heart made him a favorite with this little coterie, and his familiar presence is sadly missed at its gatherings. Dr. Norris was as honest as the sun, and, secure in his social, financial, and professional position, was absolutely independent. He never hesitated to do what seemed to him to be right, without reference to its probable effect upon himself or upon anyone else. As Dr. de Schweinitz has truly said, he was the "type of an ethical doctor," regulating his own conduct with the nicest distinctions of professional honor, looking with supreme contempt upon all forms of medical irregularity, and not over-ready to excuse a lapse of decorum in others. He had old-time notions about the dignity of the profession, and the modern tendency to commercialism passed him by. He filled a conspicuous position in the medical profession of Philadelphia faithfully and well, and will long be remembered and honored in its history.

MEMOIR OF J. M. DA COSTA, M.D.

By J. C. WILSON, M.D.

[Read November 5, 1902.]

The influence of character is far-reaching. It makes its impress not only upon the present, but also upon the future. Very often it increases as time goes on. It is not so much what a man does as what he is that raises him high among his associates and enables him to mould their opinions and guide their conduct. Fortunately, those gifts which make for character commonly make also for achievement. Such was the case in that Fellow of the College concerning whom this brief eulogy is written.

Oliver Wendell Holmes described medicine in a happy phrase as "The Silent Profession." Certainly a life spent in the companionship of books, in close observation in the laboratory and at the bedside, in incessant toil for the prevention of illness and the relief of suffering, affords neither time nor opportunity for declamation. Even the demonstrations and lectures of the teacher of medicine find expression rather in the tones of friendly conversation than in those of rhetorical display. Nor is medicine dramatic. There is neither marching nor countermarching. Its victories are without pageant, its triumphs without pomp. They are not, however, the less real. It has its comedies and its daily tragedies, but they are staged without rehearsal and presented without premeditation. There is little matter in the life of the physician for story-telling. It is commonly a life of quiet toil, self-contained, given to personal services, reticent, especially among the largest-minded, and, above all, lonely. This we see

around us and learn from the biographies, mostly scanty, and from the autobiographies, always written in old age. The career of Edward Jenner, who by a single piece of work long and well thought out, rescued a world and made his name immortal, is conspicuous in the long line from the myth-enshrouded fathers of the healing art in the Island of Cos to the present time in material for the biographer and panegyrist. In truth, in the medical profession usefulness is the measure of greatness.

We cherish the memory of the founders and early Fellows of the College. Redman, Morgan, Shippen, and Benjamin Rush are not mere names to us; they are living personalities. Their influence is felt in the daily life of this great institution. What if they be forgotten by a profession careless of its traditions and a people ignorant of its history? Here, within these walls, they are ever present, living in the work they have done and in the succession which they established. So with the Fellows of later periods of our history, many of whom seem to us only a little while ago to have passed away. Is their memory not sacred to us? Do we not feel their influence? Thinking of them, we realize that it is good to have had them here. We need have no fear concerning the memory of our own best; the future will take care of them. To those who come after us their lives will be an example, their memory an inspiration. But we who have been with them hand-to-hand and talked with them face-to-face may make them more real to our successors by a few words of affectionate remembrance. It is a wise and pleasant custom of the College.

Jacob Mendez Da Costa came of an ancient Portuguese family long resident in London. He was born on the Island of St. Thomas, in the West Indies, on February 7, 1833, and was educated in Europe, chiefly in Dresden. During that period he acquired a familiarity with Greek and Latin, a fine knowledge of classical literature, and a proficiency in modern languages which served him in good stead throughout his life. It is related of him that with an excellent knowledge of English and familiarity with its literature, his colloquial command of our language was

at his coming to America inferior to that of several Continental tongues, especially German and French—a deficiency which in the course of a short period he so completely overcame that there remained no trace of alien accent in his speech, singularly accurate, graceful, and resourceful, as we all knew it. In 1849 he came to Philadelphia, where his mother was then living, and shortly afterward entered upon the study of medicine in the Jefferson College and as a student in the office of Professor Mütter. The Faculty at that time was composed of Robley Dunglison, Huston, Joseph Pancoast, John K. Mitchell, Mütter, Charles D. Meigs, and Franklin Bache. His diligence in his work attracted the attention of his instructors, and it was at once an indication of their confidence in him and of his early interest in pathological anatomy that he was appointed during the second year of his course, together with his friend and fellow-student, John H. Brinton, to demonstrate to such members of his class as desired to avail themselves of the opportunity the tumors and other specimens removed by Professor Mütter at his clinics. Those demonstrations were conducted twice a week, in the evenings, and were well attended. He was graduated in medicine in March, 1852, having just entered upon his twentieth year. The title of his thesis was "Cancer and Epithelial Growths of the Face." A few months later he went to Europe and devoted a year to medical studies, chiefly clinical. The greater part of this period was passed in Paris, a capital which at that time still maintained its prestige in clinical medicine and offered peculiar attractions to the American student, for as such young Da Costa now regarded himself. He was indefatigable in availing himself of the opportunities at hand. His time was consumed in study and attendance upon the clinics. He went regularly to the great hospitals, the Hôtel Dieu and La Charité, and often to the Salpêtrière, the Lourcine, and du Midi. He effected arrangements by which he was enabled to attend the meetings of the Académie de Médecine, a privilege not generally extended to youthful strangers. With all this work he found time to take lessons in water-color painting, in which he acquired a degree of proficiency

which proved of great use in the preparations of the sketches and diagrams soon to be required in his own teaching. A review of this period of Da Costa's life makes it evident that he was already laying broad plans for the future. Not yet twenty-one years of age, he was prepared to take his destiny in his hands. He would be a teacher; at all events, he would fit himself to be one. The talent was inborn. It had shown itself in the eagerness with which as Mütter's pupil he had undertaken the demonstration of the clinical specimens to his fellow-students. Crude these early attempts doubtless were—how could they have been other than crude?—yet they were the first signs of that rare association of gifts which made him in later years the greatest clinical teacher of his time. The one fact that stands out clearly is that he was not only eager to know the things that were taught, but that he was even more eager to know how they were taught. His chief attention was given to pathology and clinical medicine, but he interested himself in every branch of medicine as it was then taught. Wherever there was a great master to be heard, there he went as time and opportunity allowed. Opportunity was far more abundant than time for the young student. The medical life of Paris was approaching the culmination of nearly a century of greatness. There had been great teachers before, even greater than then, but rarely, perhaps never before, such a brilliant group of investigators and clinicians. Students flocked to them from every land. Their writings, either in French or in the translations that quickly followed their issue from the press, were in the hands of the physicians of every civilized country. Paris was the capital of the medical world. Robin was teaching pathological anatomy and the use of the microscope in the study of normal and pathological histology, and, at the age of thirty-two, had just published observations upon glandular hypertrophies and the anatomical structure of erectile tumors. Claude Bernard, then forty, was working in physiology and developing experimental medicine, and had already published his researches upon the function of the spinal accessory nerve and the sugar-producing function of the liver. Valleix was teaching diseases

of the newborn, internal pathology, and therapeutics. Verneuil was carrying on his studies in visceral anatomy and the structure and functions of the circulatory organs. Duchenne de Boulogne, forty-seven years old and full of enthusiasm, was working out electro-physiological problems and demonstrating the uses of electricity, and especially of galvanism, in therapeutics. Nélaton was teaching surgical pathology; Civiale the diagnosis and treatment of diseases of the urinary passages, and Ricord venereal diseases, with a wealth of material and a positiveness of assertion all his own. Broca was teaching morbid anatomy and writing papers upon anthropology. Velpeau, the versatile—anatomist, accoucheur, surgeon, ophthalmologist, brilliant teacher, and voluminous writer—who, among other curious matters, had some years before published a brochure on medicinal injections into the closed cavities of the body, was at the very height of his fame. Such was the schooling and such the influences under which young Da Costa was preparing himself for a future even more useful and brilliant and laying long plans for work in his chosen home beyond the Atlantic. But greater than the influence of any of these was that of the profound and eloquent Trousseau, then at the very zenith of his power, and holding the younger medical world charmed with those wonderful lectures and essays which were afterward collected in the volumes known as the *Clinique Médicale de l'Hôtel Dieu*. The impression made upon the youthful student by this master was without question deep and lasting. Da Costa was no mere copyist, particularly in style; but the close observation, the command of the facts, the orderly arrangement, the emphasis of important points, the graceful use of a rich vocabulary, and the telling effect of climax characteristic of the discourses of the great French clinician were in later years to be recognized in the more terse but not less incisive or elegant method of his American successor.

From Paris, Da Costa went to Prague for a brief time, where he availed himself of clinical advantages of an unusual character; thence he proceeded to Vienna, and passed some months in the study of general pathology and diseases of the heart and lungs

under Oppolzer and Bamberger, physical diagnosis under Skoda, pathological anatomy with Rokitansky, and diseases of the skin with Hebra. It is easy to imagine the quiet criticism with which the eager student contrasted the methods of the French school, then at the verge of the decline of its popularity, with those of the Viennese, still upon the ascendant. It is interesting to observe in the choice of masters and subjects at this period the drift of his thoughts. No longer uncertainty as to surgery or venereal diseases or midwifery, but a clear course toward his lifework—pathological anatomy, visceral disease, the heart and lungs, and the diseases of the skin in their relation to general medicine; in a word, internal medicine in its broadest sense, the greatest of the specialties. Upon quitting Vienna he went for a brief period again to his beloved Paris, and then returned to Philadelphia.

Here was work ready for him. He was invited to take part in the Summer Association for Medical Instruction, an organization having its location in Chant Street, a place of historical interest in the medical life of Philadelphia, long famous for all kinds of extramural teaching. In this work he was associated with men somewhat older than himself, but still young, who had already attracted attention as teachers and practitioners. Prominent among them were John Forsyth Meigs, Frank West, the Wallace brothers, Robert Bridges, John H. Brinton, and Addinell Hewson. To Da Costa was assigned the subject of physical diagnosis. In this position he achieved an immediate success. His method of teaching and his ability as a lecturer attracted great attention, and the courses were continued for a number of years—in fact, until a growing practice and the increasing demands upon his time through his appointments at the Jefferson College brought them to a close. More important, however, were the private classes in physical diagnosis and clinical medicine which he organized about this time. These were conducted in his offices, and were continued throughout the greater part of the year. They were extremely popular, and were largely attended by advanced students and young practitioners, not only Phila-

delphians, but also men from the South and West. This form of instruction served not only to extend the young clinician's growing reputation, but also to popularize, to a greater extent, perhaps, than that of any contemporary teacher, the methods of physical diagnosis, the value of which was only at that time beginning to be appreciated by the profession at large.

In 1858 the Chair of the Theory and Practice of Medicine in the Jefferson College was made vacant by the death of John Kearsley Mitchell, and Samuel Henry Dickson, of South Carolina, was elected his successor. From this date Da Costa became closely identified with the Jefferson College, at first as an instructor of telling influence in connection with the Chair of Medicine, subsequently as clinical lecturer, and finally, in 1872, as the successor to Professor Dickson in the Chair of Practice. He was then thirty-nine years old, and had already established himself as a successful practitioner, a teacher of the highest order, and a trusted consultant. He had manifested from the beginning of his career a deep interest in the welfare of the organized profession, an interest which he maintained throughout his life. He early became a member of the American Medical Association. In 1857 he took an active part in the organization of the Pathological Society of Philadelphia, and was its President from 1864 to 1867. He was corresponding member of the Pathological Society of New York, and an honorary member of the Medical Society of New York and of the Medical Society of London. In 1858 he became a Fellow of this College, and served as its President in 1884–85 and again from 1895–98. He was one of the original members of the Association of American Physicians and its President in 1897. But his interest in scientific organizations was not confined to those composed exclusively of members of the medical profession. In 1852 he became a member of the Academy of Natural Sciences of Philadelphia, and in 1866 a Fellow of the American Philosophical Society. He was also a member of the American Academy of Arts and Sciences, the New England Historical Society, and other organizations. He served as physician to the Episcopal Hospital, to the

Philadelphia Hospital, and to the Hospital of the Jefferson College, and was for many years consulting physician to the Children's Hospital. He was a member of the staff of the Pennsylvania Hospital from 1865 until the time of his death, a period of thirty-five years. During this long service his interest in that great institution never failed. His visits were made with a regularity and punctuality with which urgent outside professional engagements were rarely permitted to interfere. His duties to the patients were discharged with consummate skill and faithfulness. Many of his most important contributions to the literature of medicine were based upon his observations in the wards of the Pennsylvania Hospital. His clinics were models of the finest methods of medical instruction—clear, systematic, and impressive. Sometimes they were telling presentations of familiar phases of disease, often keen studies of rare maladies, frequently opportune demonstrations of new facts in diagnosis or treatment, but always interesting and instructive. They were held, in accordance with the time-honored usage of the place, at the busiest hour of the morning, but the amphitheatre never failed of its full audience of eager and attentive students and practitioners. His opinion was of great weight in the counsels of the managers and of the staff, and his advice was constantly sought in matters of administration and professional policy. But the most important influence of this great clinician was that which he exerted upon the long line of resident physicians whose good fortune it was to serve with him. Some of his earlier residents are now among our older Fellows; some of his latest have only recently joined our ranks. It is needless for me in this audience to dwell upon his methods at the bedside, his diagnostic accuracy, his skill in the use of remedies, his wide and well-ordered knowledge of medicine, his still greater knowledge of men. The living ex-residents of the Pennsylvania Hospital, most of whom are Fellows of this College, pay his memory the tribute of gratitude and affectionate remembrance.

Dr. Da Costa was not a voluminous writer. The Athenian passion for going about seeking and telling something new, which

has become so widespread a malady in the medical body, did not touch him. He had other work to do. He dwelt upon a loftier intellectual level. Viewed in the light of his remarkable influence upon the profession, the list of the titles of his papers appears singularly brief; yet he did not miss opportunity save in the way that every great professional man whose time is given to his work must, for the very want of time, leave much unsaid that would be well worth telling. He wrote when he had something to say, and always said it well. What I have said of his method as a lecturer may also be said of his style as a writer. It was simple, natural, lucid, emphatic. His occasional addresses were graceful and learned. His conversation was most agreeable and suggestive, and showed wide reading outside of professional topics and a lively interest in current events.

He was fond of miscellaneous reading, and passed such hours as he could command in his library. At one period he took a keen interest in the Shakespeare Club, and frequently attended its meetings.

His early medical papers were pathological: "An Inquiry into the Pathological Anatomy of Acute Pneumonia," 1855; "Cancer of the Pancreas," 1857; "The Morbid Anatomy and Symptoms of Cancer of the Pancreas," 1858. His later communications were mostly clinical. They covered a wide range of observations, but those relating to enteric fever and valvular and functional diseases of the heart outnumbered the others. His clinical studies of the derangements of the heart in recruits, conducted during the Civil War, constituted a most important addition to the previous knowledge of functional diseases of the heart, and have been very properly spoken of as epoch-making. They attracted wide attention both in this country and in Europe. He had the wisdom to write only one treatise—the *Medical Diagnosis*. This remarkable book, unique at the time of its publication, appeared in 1864. It was, alike in design and execution, a masterpiece among text-books, and served to establish his growing reputation. Its success was immediate and general. During the author's lifetime nine large editions, each carefully

revised and collated with the advances of knowledge, were issued, and the work was translated into several foreign languages.

His breadth of view as a student is apparent in such lectures as "The Physicians of the Last Century," "Harvey and his Discovery," and "Tendencies in Modern Medicine."

His writings show throughout literary ability of so high an order that we experience a deep regret they were not given to us in larger measure—a regret that is tempered by the reflection that they are nowhere marred by the faults of haste, carelessness, or overproduction. May we not hope to see his more important papers and addresses collected in one or more volumes for rereading and reference?

Da Costa's learning and intellectual gifts and his distinguished professional attainments were everywhere recognized. The degree of LL.D. was conferred upon him by the Jefferson College, the University of Pennsylvania, and Harvard University, and he was made honorary and corresponding member of many learned and scientific organizations; but among those who came within the sphere of his direct personal influence there was a feeling for him much deeper than the admiration inspired by the recognition of his intellectual superiority and splendid professional gifts. The man was greater than the physician or the teacher. I have said that character is far-reaching. It is more than this: it makes itself deeply felt; it arouses sentiments more lofty and enduring than the admiration which is excited by mere ability even of the highest order. In his punctilious regard for duty, directness of purpose, the integrity and refinement of his daily life, a delicacy of feeling that sometimes seemed carried to an extreme, and the modesty with which he bore unusual honors, were traits that won for him upon every side, and in a high degree, respect, confidence, and affection. The great classes of the Jefferson College as students and afterward as practitioners held him in the highest honor. As a consultant his position in Philadelphia and the parts within reach was supreme. He has been well spoken of as the physicians' physician—a title that means much. To his patients he was the ideal doctor. He

brought to them the finest personal qualities and the highest professional skill, and they repaid him with love.

On January 20, 1892, there came together in the house of Dr. Weir Mitchell a little company to arrange to do Dr. Da Costa an honor. Some were doctors, some were not, but all were his friends. The purpose of the meeting was set forth in a confidential note, which read thus:

"In recognition of Professor J. M. Da Costa's distinguished labors in medical science, of his beneficent services to the community, and of the high personal esteem in which he is held, it has been proposed by a number of his friends to have two portraits painted—one to be presented to the College of Physicians of Philadelphia, of which he is an ex-President, and the other to the Jefferson Medical College, which for more than a quarter of a century has been the chief arena of his medical teaching. To this end the following committee, representing these two institutions and his friends, has been formed. You are cordially invited to become a subscriber to the fund to carry into effect this purpose."

A limited number of these invitations were sent to those whom the committee felt sure would be glad to co-operate. Scarcely half a week had elapsed before the Secretary was obliged to return contributions to the donors. The list was already full.

In April, 1860, Dr. Da Costa was married to Sarah Frederica Brinton, whose death preceded his by many years. Of this union there were two sons, one dying in infancy, the other, Charles Frederic, now a member of the Philadelphia Bar.

At the close of the session of 1890-91 Professor Da Costa resigned the Chair of Practice in the Jefferson College and was elected Professor Emeritus. The succeeding winter he held the clinics as he had done before, but at the close of that term he withdrew from all active teaching except the short course of clinics at the Pennsylvania Hospital. Those he continued to hold until his death. His interest in medical teaching, however, remained active, and in the course of a few years he accepted the position of Trustee in the University of Pennsylvania. Mean-

while his untiring devotion to his profession did not abate, and he worked on to the end.

Death came to him quickly on September 11, 1900, at his country-seat, Ashwood, near Villa Nova, and at the close of the day—quickly, but not without pain. The attack was the last of a series that had extended over several months. In the supreme agony the voice of the clinician—"Just as I expected."

The fine and gentle presence has passed away, but the keen intellect and noble heart remain to us. So our great ones come and go. Hail and farewell!

TUMOR OF THE BRAIN LOCALIZED CLINICALLY AND BY THE ROENTGEN RAYS:

With Some Observations and Investigations Relating to the Use of the Roentgen Rays in the Diagnosis of Lesions of the Brain.

By CHARLES K. MILLS, M.D.,
CLINICAL PROFESSOR OF NERVOUS DISEASES IN THE UNIVERSITY OF PENNSYLVANIA; NEUROLOGIST TO THE PHILADELPHIA HOSPITAL,

AND

G. E. PFAHLER, M.D.,[1]
ASSISTANT CHIEF RESIDENT PHYSICIAN, PHILADELPHIA HOSPITAL.

[Read February 5, 1902.]

REPORT OF THE CASE, WITH REMARKS ON THE USE OF THE ROENTGEN RAYS IN DIAGNOSIS OF BRAIN LESIONS, BY DR. MILLS.

Although in the following case the tumor was localized by clinical study, the case is chiefly of importance because it is the second one in which the position of a brain tumor has been accurately determined by X-ray investigation during the life of the patient.

The patient, a colored woman, aged thirty-two years, a laundress by occupation, was admitted to the Philadelphia Hospital October 11, 1901. Her family history was good, and no certain history of syphilis was obtained, although the infection seemed probable from some of the patient's statements.

Some months previous to her admission to the hospital, but just when she could not accurately fix, she began to lose power in her right leg. About the same time, or just previous to the impairment in her right leg, she began to suffer with headache, which gradually became more frequent and persistent. She stated that she became temporarily blind during the

[1] Not a Fellow of the College.

paroxysms of severe headache. The headaches at first would sometimes last half a day, at others for several days. The loss of power in the right leg increased, and during the month previous to her admission the right arm also became paretic.

She was first examined by one of the interns a day or two after admission. She was at that time well nourished. She complained bitterly of headache, and evidently suffered greatly. Her tongue was slightly coated and moist; her pulse was full, strong, and regular. Examination of the chest and abdomen resulted negatively.

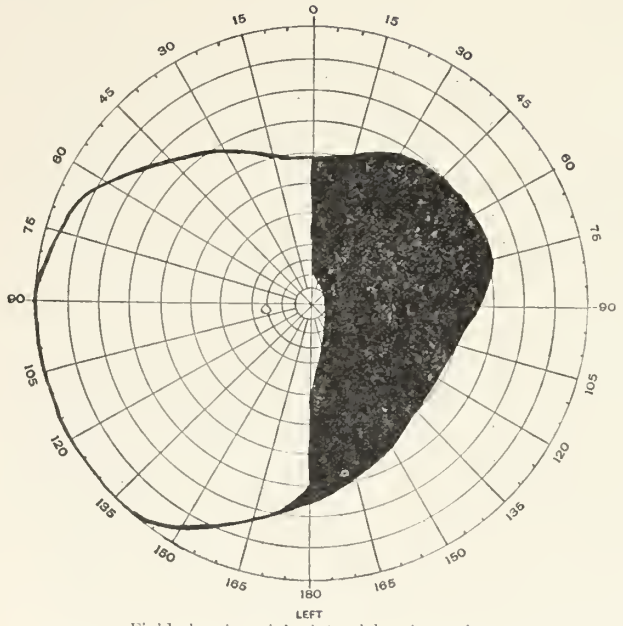
The right side of the face was paretic. Speech seemed a little slow at times, but all forms of aphasia were absent. Loss of power was marked both in the right leg and right arm, but more complete in the leg than in the arm. Knee-jerk was exaggerated on the right and about normal on the left. Patellar clonus was present on the right and absent on the left. Ankle clonus was absent, as was also the Babinski reflex, on both sides. No impairment of sensation was noted at the time of the first examination, but a careful examination for sensation was not then made. The right leg showed spasticity and tremor, and the right arm was spastic at the elbow.

The patient was examined on a number of occasions, and was twice brought into the amphitheatre and lectured upon by Dr. Mills. The conditions at the time of the first examination of the patient by Dr. Mills (about October 18, 1901) were as follows: The right side of the face was paretic; paralysis was marked in both leg and arm, but was more complete in the leg. The only movement retained in the lower extremity was partial flexion of the thigh on the pelvis. Sensation to touch and pain was nearly lost in the right upper extremity; it was but slightly impaired in the right lower extremity. Impairment of muscular sense was also a marked feature. Astereognosis was also present, and became more and more positive as the case progressed to its termination. All forms of cutaneous sensibility and muscular sensibility were tested by the usual methods, with the result of showing impairment, which, as time passed, became more and more complete in the upper extremity. The so-called senses of locality, position, pressure and spacing were found wanting. In the right lower extremity the quadriceps-jerk and knee-jerk were exaggerated, and patellar clonus was marked. The front tap phenomenon was present; ankle clonus, however, was absent, this absence being unusual in cases in which patellar clonus and front tap are present. The muscle and tendon jerks in the upper extremity of the right side were increased; on the left side, both in the lower and upper extremities, they were about normal.

On October 23, 1901, the patient's eyes were examined by Dr. G. E. de Schweinitz, who made the following report:

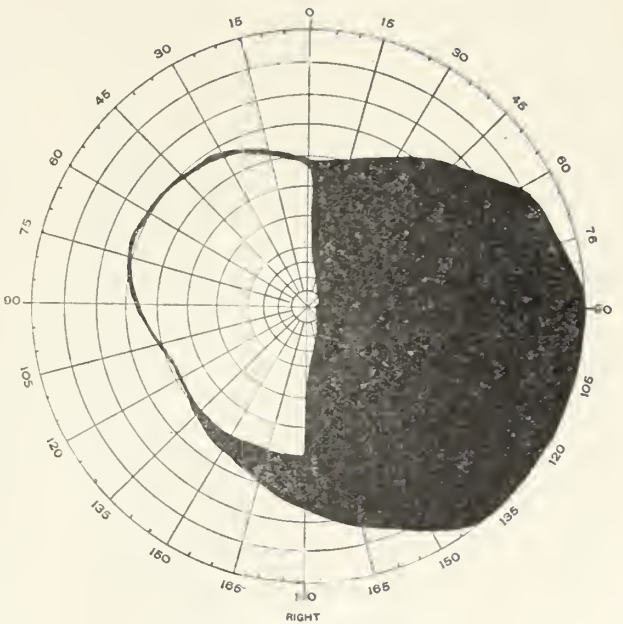
The external aspect of the eyes is normal; the visual acuity of each eye, without correction, equals 5/XXV. The pupils are round, equal in size, and

FIG. 1.



Field showing right lateral hemianopsia.

FIG. 2.



Field showing right lateral hemianopsia.

their reactions are normal in all respects. There is no difference in the width of the palpebral fissures, the levators have full power, and the rotation of the eyeballs is unimpaired in all directions. Although there is a history of diplopia, it is not possible to demonstrate double vision by the usual methods, nor does any examination reveal paresis of any external ocular muscle. With the ophthalmoscope the following conditions are evident: Marked bilateral optic neuritis (choked disk), the swelling of the nerve heads approximating 3 mm., their apices being reddish-white in color and gradually passing into a grayish tint. Upon the swollen papillæ and in the immediate neighborhood are numerous flame-shaped, fresh hemorrhages. The arteries are about normal in size; the veins are very dark in color and exceedingly tortuous. In the macular region are areas of yellowish-white infiltration somewhat similar to lesions found in renal retinitis. Examination of the visual field reveals typical right homonymous hemianopsia, the dividing line passing around the fixing point and leaving it within the region of preserved vision. The preserved half fields are of normal size. (Figs. 1 and 2.) It was not possible to obtain a satisfactory color field. The ocular examinations indicate the presence of a growth situated in an area posterior to the primary optic centre, where it can interfere with the usual pathway.

The subsequent history of this case up to the time of operation and death can be condensed into a few sentences. The patient's headache became more agonizing and she had few intervals of even partial relief. In consequence of her suffering she became depressed and emotional almost to the point of mental derangement. At times she exhibited some hebetude, but she did not at any time present the peculiar psychical symptoms which are present so often in prefrontal disease. Her mental powers were well preserved throughout, and aphasia never developed. Gradually her sight became more and more impaired, until she was almost totally blind in both eyes. As long as it was possible to test her vision the right lateral hemianopsia could be demonstrated. The paralysis of leg and arm, the paresis of the right side of the face, and the sensory changes, including the astereognosis, remained much as described in preceding paragraphs. Impairment of sensation in the right leg increased somewhat, but was always moderate in degree, while in the right arm loss of sensation became more profound toward the last. All the deep reflexes remained considerably exaggerated in the extremities of the right side.

A tumor was diagnosed from the general symptoms, and, owing to the combination of motor paralysis with impairment of cutaneous sensation, astereognosis, and hemianopsia, the diagnosis was made of a dense tumor of large size, probably in the main subcortical, situated chiefly in the parietal region, possibly invading the motor region, and extending to or compressing the posterior limb of the internal capsule and the optic radiations where they approach one another in the region of the basal ganglia. The diagnosis was confirmed by my colleague, Dr. W. G. Spiller, who saw the case with me in consultation on several occasions. I hesitated for some time about advising operation, because of my belief that the neoplasm was in large part at least subcortical, and yet knowing that enucleable encapsulated tumors of considerable size in this and other regions are operable, and believing that there was at least a chance of success in an otherwise hopeless case, I finally advised surgical procedure. To some extent I was influenced in this advice by the terrible sufferings of the patient, who became urgent to have the operation done.

About this time Dr. G. E. Pfahler, who has been doing much extremely valuable work with the X-rays at the Philadelphia Hospital, expressed a wish to corroborate the clinical localization of the growth by means of the Roentgen rays. I was glad to accede to this request, although my previous experience with the rays in attempted localization of tumors had not been successful. In 1900 I called in Prof. Arthur W. Goodspeed, of the University of Pennsylvania, to assist in the localization of a suspected cerebellar tumor in the case of a child. The investigation was carried out with great care, but the skiagraph did not show any shadow indicating the presence of a tumor. On two occasions I have had efforts made to locate tumors in the pelvis by means of the X-rays—once by Prof. Goodspeed, and in another instance at the Pennsylvania Hospital, in a case seen in consultation with Dr. A. V. Meigs. In the latter case a doubtful shadow was obtained, in the former the result was negative.

In one of these cases the tumor was subsequently partially removed by Dr. De Forest Willard. In both cases the patients died in a comparatively short time after the X-ray investigation, and in both cases tumors of large size were found postmortem.

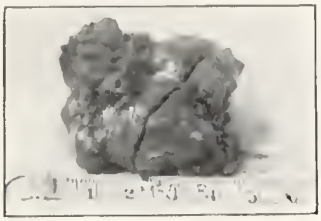
In the brain tumor case under discussion a shadow was obtained by Dr. Pfahler which seemed to exactly confirm the clinical localization of the tumor. A further discussion of the use of the X-rays in localizing tumors and other encephalic lesions, and a report by Dr. Pfahler of his experiments in this case, and other experiments suggested by me to be made on the cadaver, will be given later.

The operation was performed December 11, 1901, by Dr. W. J. Hearn, assisted by Dr. J. Chalmers Da Costa. It was decided to do an osteoplastic operation, and as it was believed that the main mass of the tumor was in the subcortex of the parietal lobe, although it probably reached into the motor region or injured the motor fibres subcortically, the operation was planned with the view of exposing the superior and inferior parietal convolutions and the motor region to a point one inch in front of the central fissure. The superior line of the flap was parallel with the mesial line of the skull, about half an inch (1.27 cm.) from it. From a point on the skull corresponding presumably to a point in the brain one inch (2.54 cm.) in front of the central fissure it reached backward for a distance of about three inches (7.62 cm.). The anterior and posterior sides of the flap were about the same length as its superior border, trending inward toward the base in the usual manner of an osteoplastic operation. Hemorrhage was not excessive, but considerable time was required to make the bony flap. When the dura was exposed it was found somewhat tense and bulging, with no visible pulsation of the brain. On turning back the dura a nodulated mass was found bulging into the opening, and exploration with the finger showed that on the surface of the brain at least this did not extend beyond the opening. In a few minutes this mass, about 1.8 inches (4.5 cm.) in its greatest diameter, was shelled out (Fig. 3), and at first it was supposed that this was the entire tumor, but, as will appear later, the tumor was broken off below the surface of the brain.

The operation was necessarily prolonged. The patient did well during its early stages, but by the time that the partial removal of the growth was effected she was in a critical condition, and although every effort was made to save her life by hypodermic injection of strychnine and whiskey, injection of salt solution, and inhalation of oxygen, she died within two hours after the completion of the operation.

I am convinced by my observations in this and in other operations for the removal of brain tumor, that it is of the utmost importance that some speedier method of opening the skull and some method accompanied by less cranial concussion should be employed. Large openings are necessary, and the osteoplastic operation has many de-

FIG. 3.

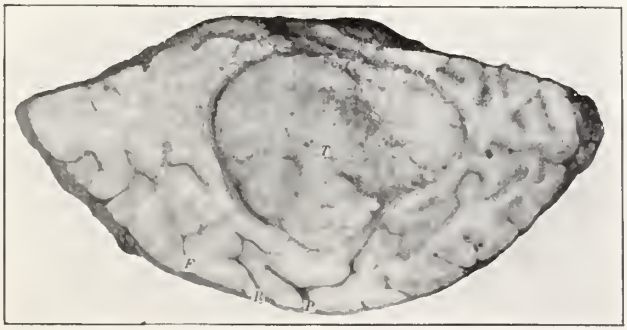


Portion of tumor removed at operation. The scale below shows the width of tumor.

FIG. 4.

Photograph of the lateral aspect of the left cerebral hemisphere, showing the cavity (C) from which a portion of the tumor was removed; the portion removed is shown in Fig. 3. The line B B shows the level of the horizontal section of the brain shown in Fig. 5; the line A A the level of the horizontal section shown in Fig. 6.

FIG. 5.



Photograph of a horizontal section of the brain, made at the level B B in Fig. 4. T, tumor; F, precentral fissure; R, central fissure: P, intraparietal fissure.

cided advantages, giving a large flap and also allowing the replacement of the bone, which usually retains its vitality in cases which survive the operation. If the dental engine and its necessary accessories could be so perfected as to make its use practicable for opening the skull, and if surgeons became skilful in its use for this purpose, I believe that lives that are now lost would sometimes be saved, and cranial surgery, especially brain tumor operations, would have a much more hopeful outlook.

Dr. Hearn informs me that an instrument has been devised by Dr. Thomas Stellwagen, Jr., a student in the Jefferson Medical College, which will saw out an osteoplastic flap with great celerity and satisfactorily, thus doing away with the tedious chiselling and its accompanying concussion. The instrument has been used in a case in the Jefferson College clinic by Prof. J. Chalmers Da Costa with great satisfaction and success.

At the autopsy calcareous endocarditis, chronic interstitial nephritis, and congestion of the lungs, with emphysema, were found. On dissecting back the scalp through the opening made by the osteoplastic operation a shallow cavity was seen in the brain, occupying the anterior half of this opening in the skull and extending for about a quarter of an inch (0.62 cm.) under the anterior ledge of bone. The calvarium and dura were removed, and careful investigation of the appearances and conditions made. It was found that the centre of the upper border of the cavity in the brain corresponded to the summit of the central fissure of the opposite side. Below the cavity the lower portion of the central fissure was found in such a position as to indicate that the cavity from which the mass had been removed was so situated that its middle portion from above downward would correspond almost exactly to the central fissure. The vertical and the antero-posterior diameters of the cavity were the same, 1.8 inches (4.5 cm.). On examining the cavity it was found that the tumor had been broken off, and that a large portion of it remained in the subcortex. The accessible remaining portion was situated chiefly in the lower and posterior portion of the cavity. A photograph of the lateral aspect of the hemicerebrum showing the cavity is seen in Fig. 4. No other gross lesions of the brain were found. The posterior portions of both eyeballs with optic nerves were removed and showed swelling and other evidences of choked disk. These specimens were placed in the hands of Dr. G. E. de Schweinitz for microscopical investigation.

The fragment of tumor, the brain, and other specimens of the nervous system were transferred to Dr. W. G. Spiller, who reports

that microscopical examination of the tumor shows it to be a fibrosarcoma.

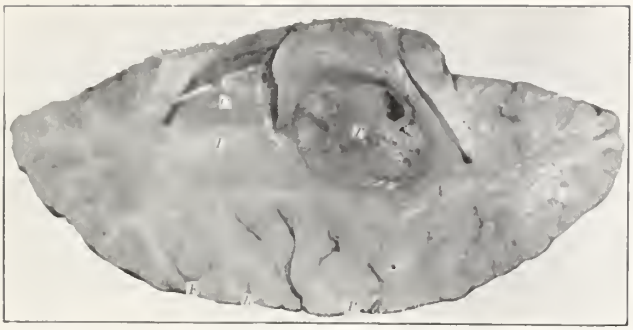
After hardening the brain in formalin several horizontal sections of the brain were made at different levels, the first beginning below the lower margin of the cavity in the lateral aspect of the cerebrum, the others at short intervals, so that the lowest section just uncovered the knee of the internal capsule. The appearances presented by two of these sections, one made at the level represented by the line B B and the other by the line A A (Fig. 4) are shown in the photographs. (Figs. 5 and 6.) It will be seen that the tumor was largely subcortical, reaching to but not invading the thalamus and internal capsule. Its position was such that it involved chiefly the white matter of the inferior and the superior parietal convolutions (subparietal and parietal of Wilder) and the middle portion of the postcentral convolution.

The only case previous to the one reported in this contribution in which a brain tumor has been clearly localized by means of the X-rays in the living subject is one recorded by Church,[1] of Chicago. Church, with the assistance of Mr. W. H. Fuchs, of Chicago, experimented with the X-rays in a case in which a cerebellar tumor was suspected. Skiagrams of the tumor were obtained and are given in the paper containing the account of the observations. The patient, a boy, fifteen years old, was exhibited to a class of physicians as a case of cerebellar tumor, the skiagrams being used at the same time to show the value of the Roentgen rays for diagnostic purposes. It was held by Church that the shadow showed a growth which could not be of a character homogeneous with that of the brain tissue. He also presumed that the tumor was highly vascular and that the blood extravasated into the tissues of the tumor gave the shadow. The boy subsequently died, and at the autopsy a highly vascular gliomatous tumor was found, the tumor being the seat of several old hemorrhages and also a recent clot of considerable size. The skiagrams in this case showed a clearly distinguishable nodulated outline. The tumor was inoperable.

Some interesting points with regard to technique are given in this

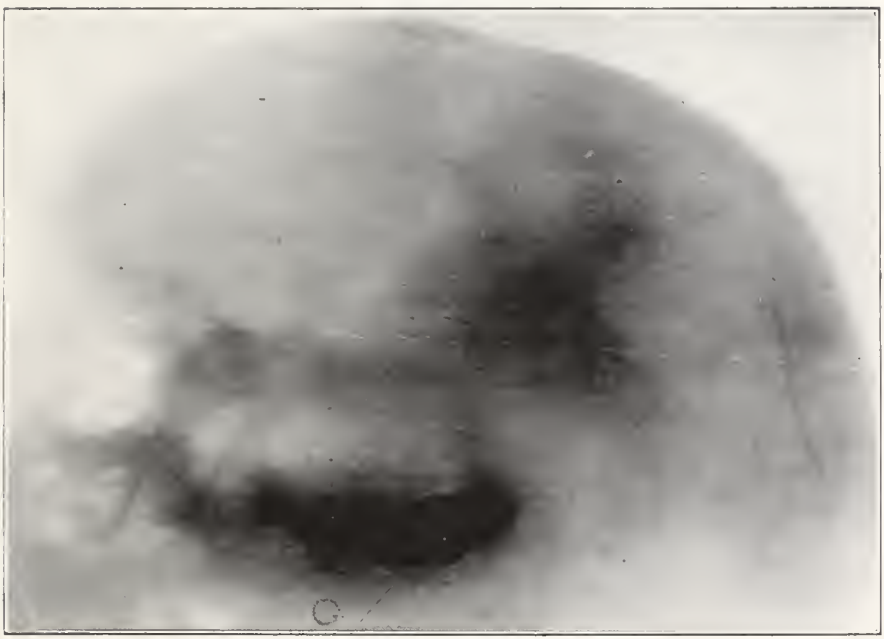
[1] American Journal of the Medical Sciences, February, 1899, N. S., vol. cxvii.

FIG. 6.



Photograph of horizontal section of the brain made at 2.5 cm. below that represented in Fig. 5. This section represents about the lowest level of the tumor, which at this point has undergone cystic degeneration. T, tumor; C, head of the caudate nucleus; I, anterior limb of the internal capsule; F, precentral fissure; R, central fissure; P, intraparietal fissure.

FIG. 7.



Brain tumor shown in the living subject. The following are noticeable: Outline of scalp, hairpins, outer table of skull, diploë, and inner table; bones of face, frontal sinuses, ethmoidal, sphenoidal and mastoid cells, and base of skull; also shadows corresponding to the depressions and elevations in the skull for the frontal convolutions. The shadow of the tumor is shown between the frontoparietal suture and the posterior meningeal artery.

paper, and the skilful and varied experiments of Dr. Pfahler in our case showed the great importance of attention to special details in the work. Church records that Mr. Fuchs stated that it was important to make an exposure of proper duration, and that underexposure or overexposure produced an entirely different result. "An ordinary focusing tube of proper vacuum was employed at a distance of eighteen inches from the photographic plate on which the head rested. The exposure was three and a half minutes." The reader is referred to the report of Dr. Pfahler's experiments given below for details of the methods employed by him. It is interesting to note from the report of the autopsy on Church's case that the bones of the cranial vault were very thin and unusually translucent, as a similar thinness of the bones was present in our case.

Obici and Ballici[1] demonstrated by the X-rays the presence of tumor in the case of a boy who died of brain tumor, the experiments being performed postmortem. They also experimented with tumors of different kinds placed in the brain of cadavers, and were able in some instances to obtain localizing shadows. Others, including Oppenheim,[2] have made similar experiments. Oppenheim, in discussing the subject of brain tumors in his text-book, says that his attempts to use the X-rays for diagnostic purposes failed, although he was able to determine that a tumor placed within the cranium upon the brain was very distinctly noticed.

The tumor in the present case, according to the report of the microscopical examination furnished by Spiller, was a fibrosarcoma. It can, therefore, be concluded that tumors of this class, and also, as Church has suggested, calcareous masses, tuberculomata, dense fibromatous tumors, and thickly encapsulated abscesses can, under favorable circumstances, and with skilful technique, be demonstrated by the X-rays.

Some of the observations made by Dr. Pfahler indicate the probability that the X-rays can be used to assist in the diagnosis of other lesions and conditions than tumors and encapsulated abscesses. It will be noted by a study of the skiagrams that the absence of tissue

[1] Rivista di Patholog., October, 1897, cited by Church.

[2] Diseases of the Nervous System. Translated by Edw. Mayer, M.D., Philadelphia and London, 1900.

in some of the brains experimented upon was clearly defined. In one case, in which he made a careful X-ray examination, an aphasic presumably suffering from necrotic softening or an old cyst of Broca's convolution, the skiagram, compared with the skiagrams of brains presumably normal, showed in the position of the suspected lesion a relative absence of shadow. This suggests the idea that in some cases in which the location of a lesion can be readily determined by clinical study, but in which its nature is in doubt, the X-rays may be used to assist in the differentiation of the character of the lesion, and thus be of practical value in reaching a conclusion as to prognosis or as to the advisability of operation in a case in which surgical procedure is under consideration. If certain lesions are less dense than the brain substance and not homogeneous with it, the contrast in the skiagrams between the appearances exhibited by the normal and abnormal tissue should be of diagnostic value.

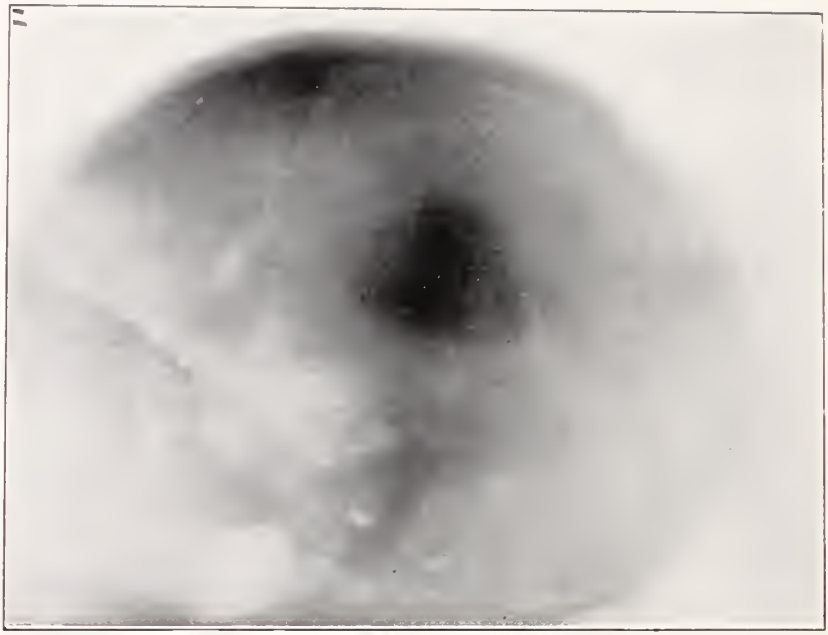
Subjoined is the report of Dr. Pfahler of his observations with the X-rays in the case here recorded, and also of other interesting X-ray investigations on the cadaver.

REPORT ON THE ROENTGEN RAY INVESTIGATIONS. BY DR. PFAHLER.

It occurred to me that the case of Dr. Mills would be a suitable one in which to test the value of the X-rays in the diagnosis of brain tumors, and having obtained his consent and that of the patient, she was placed in the proper position and an exposure of four minutes made with a moderately hard vacuum. I placed the anode of the tube directly opposite to the area in which Dr. Mills had located the tumor and at a distance of eighteen inches from the plate, for the reason that at this distance the shadows in the upper side of the skull would be dissipated by the divergence of the rays, and yet good definitions of the structure on the opposite side of the skull would be obtained.

A negative was obtained which showed good detail of all the structures — namely, the scalp, the outer table of the skull, the diploë, and the inner table, the frontal sinuses, the ethmoidal, sphenoidal, and mastoid cells, the coronal suture, the groove of the posterior meningeal artery, the outline of the base of the skull, and

FIG. 8.



Tumor inserted in the motor area of the unhardened brain of the cadaver. In the skiagram are shown the outline of the skull, auditory meatus, mastoid cells; also fronto-parietal and parieto-occipital sutures, and middle meningeal artery. The dense shadow of the tumor is seen directly over the central fissure, the clear space about the tumor indicating the absence of brain tissue.

shadows corresponding to the depressions for the frontal convolutions. A large shadow lying between the coronal suture and the posterior meningeal artery corresponded to the area in which Dr. Mills had located the tumor. (Fig. 7.)

For comparison, a colored woman of the same age, an epileptic, was then selected, and a similar exposure of her brain and skull made. This negative did not show the shadow of the tumor as seen in the first plate, but showed diffuse shadows throughout the cerebral portion. These can probably be accounted for by the thickness and density of her skull, which is indicated by the absence of all sutures and bloodvessels as well as the thickness of the outer table. The absence of these lines was not due to a poor negative, as shown by the fact that good definition was obtained of the base of the skull and mastoid cells. I then repeated the exposure upon the patient with the tumor, and obtained the same shadows as before.

A second negative made from the epileptic showed no tumor. The matter was then presented to Dr. Mills, and he agreed with me that the shadow obtained in the case of his patient was probably that of the tumor. Its definite outline in the upper portion seemed to indicate that it was superficial, and, therefore, removable. A shadow of a tumor of the central or deeper portion of the brain would be more dissipated.

At the operation the upper portion of the tumor was removed, the part removed corresponding to the upper portion of the shadow. Autopsy showed a large remaining subcortical portion of the tumor, this corresponding to the remainder and less definite part of the shadow.

Dr. Mills then suggested that I make some experiments upon the cadaver. The first subject was a man, sixty-three years old. I hoped to prove that a tumor could be shown in any of the usual locations. The usual incision for the removal of the scalp was made, and the left half of the cranial vault removed, leaving the right intact. Without disturbing the brain, carefully replacing the section of bone and the scalp, I made a negative to show the normal shadows of this particular skull. I then removed a section of brain from the central part of the motor area, corresponding in size and shape to a hardened cerebellar tumor, the specimen being from a case

reported by Dr. Lloyd. I placed the tumor in the cavity made for it and replaced the section of bone, and sutured the scalp so as to preserve as nearly as possible the conditions that would be found in the living subject. The negative made showed a very distinct shadow of the tumor. (Fig. 8.)

The tumor was removed from this site and placed in the frontal region, having for its inferior boundary the first left frontal convolution and for its posterior central fissure. The brain tissue was replaced in the first site and a negative made which showed the tumor, but with a less dense shadow than in the first position. This was probably due to a more penetrating light. This plate showed the absence of brain tissue where it had not been cut to fit the tumor exactly.

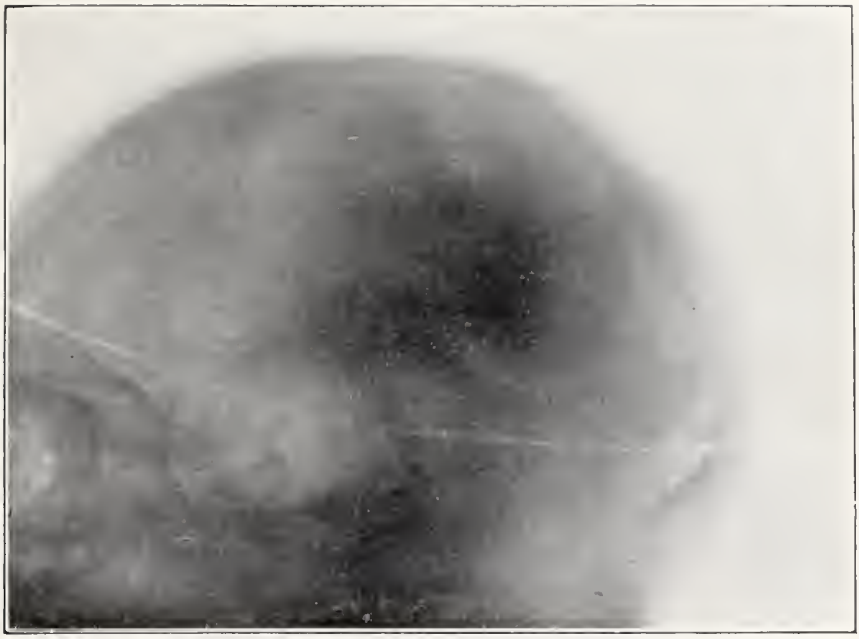
The tumor was now placed in the posterior portion of the left hemisphere, the frontal section of the brain replaced, and the brain closed as before. This negative not only showed the tumor, but also the outline of the section of brain in the frontal region, which had been replaced. (Fig. 9.)

Dr. Mills and Dr. Spiller reminded me that a hardened tumor in a fresh brain might not be a fair test. To harden it the brain was placed in a 10 per cent. formalin solution for fifteen hours. It was then returned to the skull and the tumor replaced in the motor area. A good shadow of the tumor was obtained, and the markings of each section of the brain tissue previously removed and replaced were shown. (Fig. 10.)

My second subject was a white woman, twenty-nine years old. In the series of experiments performed on this woman's case I hoped to prove that a cerebellar tumor could be located, and also that the different varieties of tumors could be photographed. As in the previous series, my photographs were of the normal conditions present. I used all the free tumors obtainable. The first was a cerebellar sarcoma from a case studied by Dr. James Hendrie Lloyd, the specimen being preserved in the Pathological Museum of the Philadelphia Hospital.

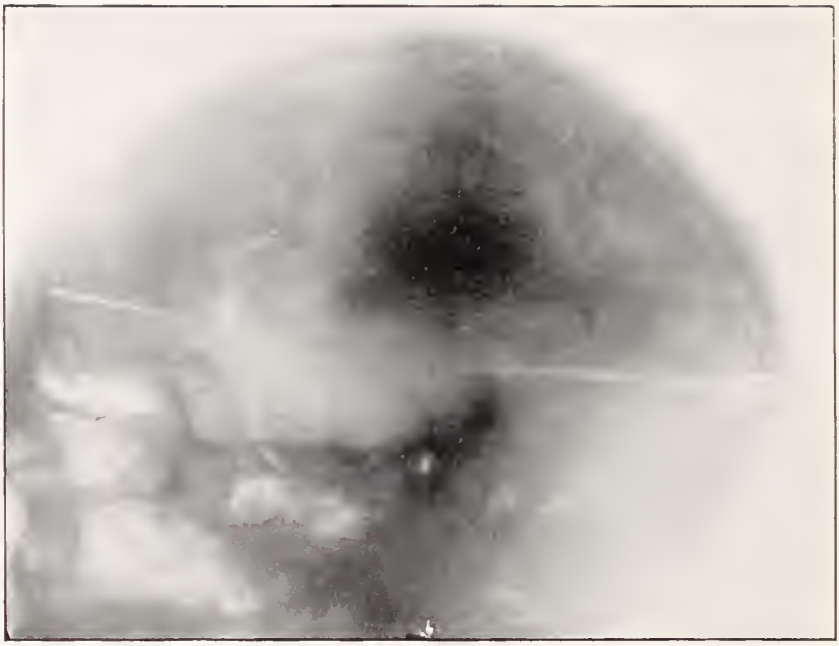
The tumor was placed as nearly as possible in the same position in the cerebellum of the case experimented on as it was in Lloyd's case. A definite shadow was obtained. I then used a perithelioma

Fig. 9.



Tumor inserted in the posterior portion of the cerebrum, the brain being hardened. Noticeable are the outline of the outer table, diploë, inner table of skull, and base of skull, frontoparietal and occipitoparietal sutures, and bloodvessels in anterior portion. The tumor is seen lying posterior to the normal dense shadow and anterior to the occipitoparietal suture.

Fig. 10.



Tumor placed in a brain hardened fifteen hours in a 10 per cent. formalin solution. A distinct shadow of the tumor is seen in the motor area. The outlines of sections of the brain in the anterior and posterior portions of the cerebrum are also visible, these portions of the brain having been removed and replaced before hardening. Details of the skull, etc., are shown as in the other skiagrams.

which had been removed from a case of Dr. Mills. The tumor was photographed in the central part of the motor area. The next was an endothelioma loaned by Dr. Spiller. This was also placed in the motor area, and a shadow was obtained of only slightly greater density than that of the surrounding tissues, but the sections of the tumor itself were shown.

In another experiment a large spindle-celled sarcoma of the pineal gland was placed in the motor area and a shadow obtained.

In all of this series the plates were overexposed, though exposure was only four minutes. I then repeated the series upon the body of a man fifty-four years of age, timing them three minutes, with the result that all were underexposed.

Still feeling that my results might be questioned because I had used a hardened tumor and a fresh brain, I used the following test, and repeated it: Half of a fresh brain was taken and placed beside the half of a hardened brain, and the two photographed with the tumor under the same light and upon the same plate. The hardened brain was a little larger than the fresh one. The negative showed more detail in the hardened brain, but the density of the shadow was little if any greater than that of the fresh one. The shadow of the tumor was more dense than either.

From the foregoing experiments the following conclusions may be drawn:

1. That fibrosarcomata, and probably other tumors, can be photographed in the living subject and their location and extent shown.

2. That various tumors can be photographed in their most common locations.

3. That other abnormalities and deficiencies in brain tissue itself can be photographed, which will probably be of value in the diagnosis of cysts, softening, and hemorrhages.

4. That overexposure of the third series and the underexposure of the fourth show that good results will only follow the most careful technique and keen judgment as to the special conditions in each case.

5. That the shadows obtained in the normal parts of the brains studied indicate that great care is necessary in the interpretation of any shadow obtained in the living subject.

DISCUSSION.

Dr. G. E. de Schweinitz: The ocular lesions presented by Dr. Mills' patient will be fully described in his paper when it is published. In brief, they were double optic neuritis, the so-called choked disk, of that character usually seen with brain tumors, and absolute right lateral hemianopsia. The pupillary reflexes were normal—that is to say, the so-called hemiopic pupillary inaction, or Wernicke's symptom, was absent, the response of the iris to a beam of light thrown into the pupil being equally prompt when the rays fell upon the blind and upon the seeing side of the retinas. This symptom is usually sufficient to locate the lesion producing the hemianopsia posterior to the primary optic centres. In studying cases of hemianopsia it is always interesting to try and determine from the character of the visual defect whether the lesion producing it is situated in the cortex of the brain or in some other position. The statement that if the hemianopsia is relative, that is, if perception of color, or perception of color and form, is wanting in deficient area of the field, but light sense is preserved, the lesion must be in the cortex, although cortical lesions are not excluded by absolute hemianopsia, is not entirely correct. Indeed, if the hemianopsia is caused by a lesion of the cortex alone, this is inferred rather by the absence of other symptoms—for example, hemiplegia, hemianæsthesia, etc.—than by any definite signs, because the fact that a patient with cortical hemianopsia is said to be unconscious of his defective sight in half of his fields of vision, is not a positive sign, at least so one may infer from cases reported by Bleuler and others in which this symptom appeared when the cortex was unaffected. In this case of hemianopsia the line separating the seeing and the blind sides of the field passes around the fixation point and leaves it in the seeing half. This is frequently the case, although sometimes, as is well known, the line of demarcation passes directly through the fixation point. Many theories have been advanced to explain this phenomenon which need not be given in detail. Perhaps Schmidt-Rimpler's explanation that these peculiarities depend upon variations in the retinal fibres of the tract is suited to most of the cases. It will be noticed that the water-color of the ophthalmoscopical appearances of this patient shows an area in the macular region somewhat resembling that which is seen in the retinitis of Bright's disease. As is well known, this last-named affection and the neuroretinitis of brain tumor are sometimes singularly alike, a fact which was pointed out as long ago as 1869 by Herman, Schmidt, and Wegner. Microscopically the nerve head shows a true engorgement œdema, inflammatory symptoms being practically absent.

Dr. Leonard: I would like to congratulate Dr. Pfahler upon his success with the X-ray in locating brain tumor. I had a patient referred to me

with epilepsy by Dr. H. C. Wood, apparently due to brain tumor. I made an examination similar to that made by Dr. Pfahler, allowing the light to pass through in the lateral direction, showing tumor in the motor area corresponding to that in which the focal symptoms were located. I also made a picture in the antero-posterior direction, showing the small tumor entirely separate from the bone. The case was not, however, submitted to operation, as the other symptoms did not justify it. An interesting psychological phenomena showed itself in this case as a result, I believe, of suggestion. A year subsequently I was surprised to have the patient brought back to me by the parents with the request that he be X-rayed again, since he had been so greatly benefited. With Dr. Wood's permission I acceded to their request. It seemed that for six months after the first examination there had been no recurrence of his epilepsy. Then the attacks became more gradual. I repeated the X-ray, hoping to produce the same effect again by suggestion. The symptoms decreased, the patient had but slight attacks for a time, but finally they returned in full force. I think, as I have said, that the therapeutic result was due to mental suggestion rather than to any effect produced by the X-rays.

In regard to the technique of the X-ray, I would like to say that to the X-ray nothing is opaque—opacity is a relative term—the reason that the shadows can be produced through the skull of relatively less opaque tumors is that they add something to the normal opacity of the area in which they are found or are less dense. The more perfect the technique becomes the slighter the variations in density will we be able to recognize. Dr. Pfahler has shown that various tumors can be located in the brain. If the tumor were composed of the same structure and the same form of cell as the brain itself that differentiation would be much more difficult and probably impossible. The absence of any substance, as he has shown, will be readily determined, while the presence of cysts will probably be as readily differentiated, because their contents are more opaque than the tissues in which they lie. The possibility of showing a tumor or a normal structure in the body depends entirely on whether it adds sufficient to the relative opacity of the area in which it lies to make it possible to differentiate it from the surrounding area.

Dr. Shumway: Through the courtesy of Dr. de Schweinitz, I was able to cut the posterior halves of the eyes. As Dr. de Schweinitz has said, the sections show a pronounced choked disk, which is due to simple œdema of the tissue. A marked peculiarity is the presence in the choroid of a circumscribed thickening, due to a proliferation of its pigment cells. In a case of choked disk examined with Dr. Spiller, which was produced by an endothelioma of the dura mater, there was a similar but much larger growth in the same situation. In this case there was undoubtedly a beginning melanotic sarcoma of the choroid. The cases are certainly of great interest when considered together.

Dr. Mills closes: I would like to say one or two words in the absence of Dr. Hearn. I have had a large experience, chiefly as consultant, in connection with brain tumor operations. It is my belief that death in some instances was due to the prolongation of the operation and to the necessary concussion in osteoplastic operations, which are the only ones applicable. I endeavored in this case to have the operation performed by means of the dental engine, but it was not possible. As stated in my paper, a student at the Jefferson College has in some way perfected an instrument, and Dr. J. Chalmers DaCosta has used it with some success. If we can succeed in getting a method of this sort we will have a much larger percentage of recoveries in those cases in which tumors are accurately localized and are removable. It is better in all respects perhaps that this woman died, as a large portion of the tumor was subcortical, and death would have been inevitable. In cases of encapsulated and removable tumors, however, it has seemed to me in some instances that death was due to the prolongation of the operation.

TWO CASES OF ADIPOSIS DOLOROSA: ONE IN A MAN, COMPLICATED BY EPILEPSY; ANOTHER IN A WOMAN, PRESENTING ALSO CIRCINATE RETINITIS.

By F. X. DERCUM, M.D.,
PROFESSOR OF NERVOUS AND MENTAL DISEASES, JEFFERSON MEDICAL COLLEGE.

[Cases exhibited February 5, 1902.]

THUS far some twenty-two or possibly twenty-three[1] cases of adiposis dolorosa have been placed upon record. Of these only three have occurred among men—namely, a case reported by Ewald,[2] one by Vitaut,[3] and one by Fere.[4] The case here presented constitutes the fourth case. It is briefly as follows:

CASE I.—Charles B., aged thirty-nine years; single. Woodcarver by trade; American by birth.

Family History. Father and mother living and well. Has four brothers and two sisters who are in average health, except that one brother and one sister were for a time nervous.

Personal History. Had some of the diseases of childhood, but was in average health up to fifteen years ago, when he was acutely ill with some febrile affection which confined him to bed for over two weeks. He does not remember what the disease was, but merely that his "liver and kidneys were affected" Some time after this attack he began to grow stout. After a year or two had passed the fat began to accumulate in large masses upon the side of the chest, and upon the abdomen and other portions of the trunk. These masses were exquisitely painful to touch. About the same time masses of fatty tissue, painful to touch, made their appearance about the arms and upper portions of the forearms. Smaller deposits of fat took place upon the thighs and also in the upper parts of the legs. Like the

[1] Twenty-three, if we include the case of Renon and Heitz. Revue Neurologique, 1901, p. 704.

[2] Ewald. Berlin. klin. Wochenschrift. January, 1895.

[3] Vitaut. Maladie de Dercum, Lyon, 1901. [4] Fere. Revue de Médecine, 1901, Obs. iv.

fat in other situations, it was very painful to pressure. Neither spontaneous pain nor crises of pain were present in any of the fatty masses. He observed also that as the deposit of the fat grew he became excessively weak and easily fatigued. Very slight exertion, either in walking or in the use of his arms, would fatigue him very readily. He observed also that his flesh would bruise very easily; that slight blows would bring about black-and-blue marks. Seven years ago, after a bruise of the left leg, he developed an ulcer which was a long time in healing; a similar ulcer also developed in consequence of a bruise on the opposite leg. The ulcers were always slow in healing.

Between four and five years ago he had an epileptic seizure. The attack was preceded by an aura, which began apparently in the abdomen and ascended toward the head. Unconsciousness was complete and the convulsion general. Three months later he suffered from a similar attack, and gradually the attacks became more frequent until they occurred once a month, and more recently two or three in a week. He compares the aura to a sensation of nausea and vertigo. There was not at any time any vomiting. He frequently bit his tongue and almost always passed his urine during the attack. In addition he frequently suffered from slight attacks, which he says were not always attended by loss of consciousness. Frequently when the aura comes on he can, by rubbing his hands rapidly together, prevent the attack from maturing.

Some of the black-and-blue marks which make their appearance upon his body or limbs he cannot trace to injury. He says that sometimes he cannot account for them. He had at one time, about three years ago, also an attack of severe epistaxis, in which he lost so much blood that he was completely exhausted. He does not recall any other occasions when he suffered from any form of hemorrhage.

Status Præsens. The patient is a man very much below the normal stature, his height only being four feet ten and a half inches. He presents a striking appearance because of numerous accumulations of fatty tissue over the entire trunk. The abdomen is so pendulous that the genitals are concealed as though by an apron. Huge folds of the fat also hang from the sides of the trunk. The deposits of fat in the arms are not as great in proportion as the deposits of fat in the trunk. This is also true of the deposits of fat in the thighs and legs. Everywhere these masses of fat are exquisitely painful to pressure. All of the parts appear to be equally painful, save perhaps in the upper portion of the left side of the trunk and left shoulder, where the pain appears to be more pronounced than elsewhere. The skin is dry, but otherwise presents no abnormality.

The measurements of the trunk are as follows: The circumference of the trunk at the axilla is 42½ inches, the circumference of the trunk at the level of the nipples is 47½ inches, the circumference of the trunk at the umbilicus is 51¾ inches, and the circumference of the trunk below the umbilicus is 57 inches. The right arm measures in its upper third 16 inches, in the middle third 14½ inches, while the upper portion of the forearm measures 9¾ inches. The left arm measures at the upper third 15¾ inches, in the middle third 12¾ inches, and the upper portion of the forearm

FIG. 1.

A case of adiposis dolorosa.

FIG. 2.

A case of adiposis dolorosa.

measures 9 inches. The circumference of the neck is 15 inches. The right thigh measures in the upper third 23 inches, in the middle third 17½ inches, and in the upper third of the right leg 14¼ inches. The left thigh measures 23½ inches in its upper third, in the middle third 16½ inches, and in the upper third of the left leg 14¾ inches. Weight, 206 pounds.

It is a noteworthy fact that the lower portions of the forearms and hands and the lower portions of the legs and feet are entirely free from all fatty deposit, the skin being here indeed so fine in texture that the tendons can be very readily discerned beneath it.

There is some fatty deposit in the face, though this is much less in proportion than that which is observed in other portions of the body. There is also a dependent roll of fat beneath the chin. The face is somewhat flushed, with a tendency to lividity. Irregular flushing, with here and there a tendency to lividity, is also observed over various parts of the body. Here and there also the veins are somewhat prominent.

Extensive scarring, due to leg ulcers (one of them still incompletely healed), is present on the legs.

The knee-jerks are normal; there is no ankle clonus; there are no areas of anæsthesia nor hypæsthesia. The viscera, as far as it is possible to examine them, are normal. The urine also reveals no abnormalities.

An examination of the eyes was made by Dr. C. A. Veasey, with the following result:

There is a very slight ptosis of the left side and some weakness of the interual rectus. The appearance of the conjunctiva is very interesting. In front of the equator of the eyeball it is so translucent that the muscle fibres and the tendinous insertions of the various muscles can be distinctly seen. Back of the equator of the eyeball the conjunctiva assumes a thickened yellowish appearance, as if due to deposits of fat beneath. There are accumulations of fat in the orbital cavity which can be distinctly felt by the fingers. The reaction of the pupils to light is normal. The reaction to accommodation and convergence is present, but very sluggish, and if either eye be tested separately, the other eye beiug covered, there is a very moderate dilatation of the pupil in accommodation and convergence, instead of contraction. This result was obtained by repeated tests and confirmed by the observation of those standing by. The fundus changes are those of very high myopia. With his glasses the vision of the right eye equalled 6/XII. and of the left 6/XV. Both eyeballs are quite prominent. The media was very hazy on account of many vitreous opacities.

CASE II.—Mrs. R., aged thirty-three years; married; housekeeper.

Family History. Negative, except that the mother was a very "stout" woman, and died of an acute pulmonary trouble following the grippe, and one sister died of heart disease.

Personal History. Was always in average health previous to the present trouble. She has been married twelve years; has never been pregnant.

About ten years ago she began to suffer from pain and soreness over various portions of the trunk and limbs. At the same time she noticed that the thighs were becoming very large. Gradually some enlargement took place in the upper arms and also in the legs below the knees. Everywhere this enlargement was tender and sore to touch. These symptoms progressed gradually and slowly until at present the thighs are enormously enlarged, so much so that a large mass of fat projects forward and hangs over the knees in each leg. There is also very decided enlargement of the upper and middle thirds of the legs, decided enlargement of both upper arms and of the upper and middle thirds of the forearms. There is also some deposit of fat over the shoulders and over the trunk generally, though this deposit is not excessive and is evenly diffused.

She now complains of excessive tenderness and soreness to touch over more or less widely distributed areas of the arms, legs, and thighs, and the anterior and lateral portions of the thorax, the most sensitive areas being in the upper arm, the legs above the ankles, and the inframammary regions. There is no spontaneous pain. The soreness is elicited by pressure over the parts named or by a little unusual muscular exertion. She tires very easily—a few movements of the arms are sufficient to bring on very decided fatigue, which is especially pronounced in the arms, and she states that she is aging—turning gray—more rapidly recently than she should. She states that there is a marked tendency to discoloration of the tissues upon slight bruises or knocks, and she has had occasional attacks of epistaxis. Her station is normal; her tendon reflexes are also normal or slightly exaggerated.

There are no uterine or menstrual disturbances. Heart and lungs are apparently normal. For more than two years she has had some eye trouble, accompanied by a constant daily dull frontal headache—worse over the left eye—on account of which she applied for treatment. She sleeps well, but is "nervous" and much depressed mentally. Complains that she cannot see objects directly in front of the left eye.

The eyes were examined by Dr. de Schweinitz, who reported that the right eye is perfectly normal in all respects, while in the left eye she has a circinate retinitis—a mass of partly fibrinous and hemorrhagic exudate in the centre of the retina surrounded by crescents of fatty degeneration in Müller's fibres. Dr. de Schweinitz was not disposed to regard the condition as related to the adiposis dolorosa, from which the patient was suffering. It is important, however, to bear in mind, first, the fact that circinate retinitis is generally observed about the middle period of life, while this patient is a woman of only thirty-two; and, secondly, that the changes—hemorrhage and fatty degeneration—are after all the changes which are noted elsewhere in her body. It does not seem impossible, therefore, that both the adiposis dolorosa and the hemorrhagic and fatty changes in the retina are dependent upon the same pathological cause.

Vitaut divides adiposis dolorosa into, first, the nodular; second, the localized diffused, and, third, the generalized diffused forms.

Both of these cases evidently belong to the second group. The preponderance of the deposit in the man is upon the trunk; in the woman, upon the thighs. Although there is some enlargement of the upper arms and thighs in the man, this is comparatively insignificant when compared with the deposit upon the trunk. Both patients present in a striking manner the characteristic symptoms of fatty deposit and pain upon touch. Crises of pain or spontaneous pain, such as has been found in other cases, has not been noted in either.

Vitaut regards the fatty deposit, pain, asthenia, and the psychic phenomena as the four cardinal symptoms of adiposis dolorosa. While fatty deposit and pain are the two most prominent symptoms of the disease, marked or even grave asthenia and psychic or general nervous symptoms were so prominent in all the cases which I have myself observed, that I am equally disposed to ascribe great importance to both of these last-mentioned symptoms. The asthenia appears not to depend upon the fatty deposit, at least not directly. Thus in the case of the woman the fatty deposit does not exist at all upon the trunk, and to a comparatively slight extent upon the arms, and yet a very few simple movements of the arms bring on marked fatigue and weakness. Weakness and ready exhaustion are also marked symptoms in the man. Here they could, of course, be readily ascribed to his excessive weight and size.

As regards the psychic symptoms, there is very commonly present marked mental depression, decided mental slowness, sometimes, as in Eshner's case, hallucinations, and in others still great irritability and tendency to causeless quarrelling and even vague ideas of persecution. The neurasthenia and hysteria, which have been described in association with these cases, are, of course, to be included among these general nervous manifestations. Among the less frequent nervous complications is epilepsy, which is present in the case of the man. It has been noted in one other case, namely, in the patient reported by Dr. Frederick P. Henry.

In the autopsy made in my original case of adiposis dolorosa,[1] and also in that of Dr. Burr,[2] there were found as the most important changes interstitial inflammation of the nerves passing through the fatty deposit and also striking changes in the thyroid

[1] Journal of Nervous and Mental Disease, August, 1900. [2] Ibid., October, 1900.

gland. The latter presented signs of atrophy, together with here and there evidences of hypertrophy, a hypertrophy which appeared to be an effort at compensation. In the case of Dr. Burr there was also present an enlargement of the pituitary body, and in my own sclerotic changes in the columns of Goll. However, the neuritis and the degenerative changes of the thyroid gland were in both autopsies the most important findings.

DISCUSSION.

Dr. G. E. de Schweinitz: Ophthalmoscopical examination of the left eye of Dr. Dercum's patient reveals the lesions of circinate retinitis, an affection which was first accurately described by Fuchs, in Vienna, in 1893. In general terms this disease is characterized by a concentric aggregation of slightly raised white spots and lines around the macula. Sometimes these spots are discrete, and sometimes they are coalescent, and may surround the macula after the manner of a wreath. In the centre of this area—that is, directly in the macular region—there usually is a patch of exudate sometimes surrounded by blood, as in the present instance. Fuchs originally regarded the process as one representing fibrinous exudates in the deeper layers of the retina. Others—for example De Wecker—deny the special character of the disease, which they attribute to fatty degeneration, the result of hemorrhages. Indeed, microscopical examination indicates that the white spots consist of fat cells gathered in a region where hemorrhages had formerly been present. Nuel's theory that the white spots represent fibriuous exudates, located only in the so-called layer of Henle, and that the central layer of exudates represents a perifoveal detachment of the retina, is not borne out by clinical experience, because it is said that a similar lesion may be found upon the nasal side of the disk. Oeller believes that the condition under consideration depends upon a disease of the smallest macular vessels, especially the arteries, and this would seem to be a very reasonable explanation. There is no doubt that hemorrhages precede and accompany the affection under many circumstances. The disease has usually occurred in persons past middle age, and, therefore, in subjects that were likely to have endarterial changes in bloodvessels in other portions of the body. But circinate retinitis is in no sense a symptom of any one disease, and, therefore, cannot be regarded as part of the symptom complex of the disease which Dr. Dercum's patient represents, although it is very interesting in this connection, because if these changes in this form of retinitis depend upon hemorrhages induced by endarteritis of the macular vessels this would be somewhat in accord with the tendency of patients afflicted with adiposis dolorosa to have hemorrhages in other portions of the body. The water-colors which illustrate this retinal condition in various stages are the work of Miss Margaretta Washington.

Dr. M. B. Hartzell: Through the courtesy of Dr. Lloyd I had the opportunity of seeing this case a week ago. It seemed to me then, as to-night, quite as much within the sphere of the dermatologist as the neurologist. It is evident that there are marked abnormalities of the skin, but whether they are accidental, secondary, or an essential part of the disease, I am unable to say. When I first saw the patient there was immediately recalled to my mind a photograph seen in a recent number of the *Archiv für Dermatologie und Syphilis*. In that case there was no abnormal deposit of fat, but the condition of the skin was precisely that presented by this patient. We have here, in addition to the abnormal deposition of fat, a condition known as dermatolysis, or cutis laxa, which occurs independently, due to certain abnormalities in the skin and subcutaneous connective tissue. What the neurological relations of the two conditions are I do not know. The photograph referred to depicts a condition precisely like that exhibited in this patient minus the fatty accumulations.

Dr. D. J. McCarthy: I have had under my care a case which comes under this class of diseases. It presents certain conditions of the fat which differ from this case described by Dr. Dercum. The case is a woman, fifty years of age, who presents a very fatty appearance, especially about the arms and legs. She is the wife of a man who suffered from syphilis. For the last several years she has been complaining of these areas of fat being painful, not only spontaneously painful, but painful to pressure. A peculiarity of the condition was the presence of certain nodes in the fat which became markedly swollen and sensitive to pressure without affection of the overlying skin. The condition would last for one or two weeks, then disappear, and later another series of nodes would appear under the same conditions.

The clinical picture of this case would rather support the pathological findings in both Dr. Dercum's and Dr. Burr's investigations. In the latter case the fat contained less fibrous tissue than the surrounding fat. In my own case there was inability to determine the chemical composition of the fat and its difference from normal fat. The nodes and acute exacerbations of the skin, I am inclined to think, were merely exacerbations of the interstitial neuritis in the fat itself.

Dr. C. W. Burr: In my case there was one thing found at the autopsy not spoken of—a new-growth in the pituitary body. The glandular structure of the pituitary body was entirely gone. I am not prepared to say that the pituitary body has anything to do with the growth of fat, but we know so little about the functions of the glands, the thyroid, suprarenal and pituitary body that it is quite possible not only the thyroid but also pituitary gland has something to do with this disease. The ovaries also were remarkably sclerosed, and as the removal of the ovaries, either in human beings or animals, not infrequently produces an increase of fat, and as women at the change of life not infrequently become stout, it is possible the ovaries themselves may have something to do with the laying down of the fat, and that this, more than disease of all three glands, thyroid, pituitary body, and the ovaries, has had something to do with the disease itself.

Dr. Dercum closes: The fact that the eye ground changes are fatty and hemorrhagic is suggestive, as is also the fact that they should occur relatively early. I would suggest that in this case it has some relation to the pathological changes going on elsewhere.

In regard to Dr. Hartzell's view that the skin is affected in these cases, I desire to say that it was not affected primarily. I have seen a number of cases of relatively early stage in which there was no change at all in the skin. Other cases have certain vasomotor phenomena—flushing of the face, etc. Dr. Burr's case is especially interesting because of the possible relation of function between the pituitary body and the thyroid gland.

SNAKE VENOM IN RELATION TO HÆMOLYSIS, BACTERIOLYSIS, AND TOXICITY.

By SIMON FLEXNER, M.D., and HIDEYO NOGUCHI, M.D.[1]

[Read February 5, 1902.]

Prefatory Remarks by Dr. S. Weir Mitchell, M.D.

In 1858 or earlier I was led into a study of the poison of serpents, especially rattlesnakes. From the days of Fontana (1781) there had been no researches that added to our knowledge of the poisons of serpents. A very important paper by Lucien Bonaparte on the chemistry of the venom was the only important addition to what Fontana left. My own early papers gave rise to fresh investigations on the part of eminent inquirers, such as Sir Joseph Fayrer, Dr. Lauder Brunton, Vincent Richards, and Dr. Wall, who have made important contributions.

The subject was again taken up by me in 1883, 1884, and 1885, in conjunction with Prof. Reichert. The results were published by the Smithsonian Institution in 1886. Since then, in conjunction with Dr. Alonzo Stewart, in 1897, I have written another paper, and of later years there has been a great deal of very interesting experimentation in France, Scotland, and India. It would be perfectly needless for me to state what portion of our present knowledge is owing to my own work alone or that of other men. I think I may say that the foundation of all modern research on this subject was successfully laid in my earlier papers, and that in no important results have they been contradicted.

Last year I requested Dr. Flexner and Dr. Noguchi to resume the study of the effect of venom on the blood, a subject in which I have been deeply interested. In fact, I had planned a long series of researches in 1897, when, unfortunately, Dr. Stewart accepted other duties and my work was interrupted.

[1] Not a Fellow of the College.

Last winter I drew up a set of questions as to various points in the study of venom which I wished considered. I pointed out the direction this work should take, and, in a measure, how it was to be done. Then, having secured a liberal grant from the National Academy of Sciences, I resigned the conduct of the experimental work to Prof. Flexner and his very able assistant, Dr. Noguchi. No larger credit for the admirable and quite revolutionary results obtained belongs to me.

Introduction. *General Considerations Concerning Hæmolysis and Bacteriolysis.* The following research which is presented at this time in abstract was conducted under a grant from the Bache Fund of the National Academy of Sciences. It forms the first instalment of a new study of venoms upon which we have been engaged during a year past, and which, it is hoped, will be continued during another year or longer.

While the new studies upon venom are still incomplete the data here given have been worked out in detail, and may, therefore, be accepted as final. On account of the large number of tables which will be given in the final publication, and the many drawings necessary to properly illustrate the text, more or less delay in bringing out the full work will be inevitable. But inasmuch as the results of the studies form an integral part of the work on hæmolysis and bacteriolysis that is now attracting so much attention among bacteriologists and pathologists, and, moreover, since they contain certain facts of fundamental importance bearing on the theory of these phenomena, it seemed best not to delay publication until the entire series of researches should have been completed.

At present we shall not give the full bibliography. Since the fundamental studies of S. Weir Mitchell and his collaborators,[1] the effects of venom upon the blood and the nervous system of animals have been generally recognized. The rapid putrefaction which sets in after poisoning with venom was also explained by Welch and Ewing's[2] observations on the loss of bactericidal power of the serum of such poisoned animals. The close relationship of the poison with certain toxins of bacteria and of higher plants was shown by the discovery of Sewall,[3] of Calmette,[4] and of Fraser,[5] that animals

[1] Smithsonian Contributions to Knowledge, 1860, xii., and 1886, No. 647.
[2] Lancet, 1894, i. p. 1236.
[3] Journal of Physiology, 1887, viii. p. 203.
[4] Ann. de l'Institut Pasteur, 1894, viii. p. 275.
[5] British Medical Journal, 1895, p. 1309.

could be immunized from the effects of venom, and that they yielded an active antitoxin. That the poison of venom is not simple, but that it consists of a complex of constituents of a proteid nature was proven by Mitchell and Reichert. The time, therefore, seemed ripe for a further study of the physiological effects of venom upon the blood, upon bacterial life, and upon tissues in the light of the recent studies upon various kinds of immunity.

For the purpose of these studies dried venom has been employed. Fortunately several kinds were happily available—through the kindness of Prof. Reichert, that of the rattlesnake (*Crotalus adamanteus*); of Dr. Joseph McFarland, that of the water moccasin (*Ancistrodon piscivorus*) and of the cobra (*Naja tripudians*), and of Messrs. Mulford & Co., that of the copperhead (*Ancistrodon contortrix*). We wish to express to these gentlemen our great appreciation of their kindness.

Before presenting the matter of our studies, it seems best to preface what we have to say with a brief statement of some of the facts and views relating to the phenomena of hæmolysis and bacteriolysis. In this preface we shall not distribute credits for the work or the views here embodied, inasmuch as this will be done in the complete publication. Only so much will be said as is necessary for an understanding of the experimental data relating to venom which are to follow.

By hæmolysis is meant solution of the blood corpuscles. The term is usually applied to solution of the red corpuscles, but the white cells are also subject to a similar solution. It is, therefore, correct to speak of hæmolysis when both kinds of cells, erythrolysis when the red cells only, and leukolysis when the white cells alone are dissolved. In this solution of the red cells, which is the type of hæmolysis, the hæmoglobin is separated from the stroma of the corpuscles. The separation of hæmoglobin by hypotonic solutions and through the action of destructive chemical substances is not considered in this article. Hæmolysis as here employed refers to such separation through the action of complex agents derived from living plants or animals. This form is distinguished as biological hæmolysis. Of all such agents, the most active are found in the blood plasma or serum of alien animal species. Others are the products of cellular activity, such as venom, certain toxic products of bacterial growth, as tetanolysin, staphylotoxin, etc., and still others

are yielded by some of the higher plants, as croton from *Croton tiglium*.

The most familiar examples of hæmolysis are supplied by the effects of the transfusion of animal blood into man. It was early discovered that the practice was dangerous, for the reason that the red corpuscles of the hosts were dissolved by the foreign blood. This effect was quickly seen to be due to the serum of the alien blood, and it was observed to take place with equal readiness *in vitro*. The blood of animals is also hæmolyzed by foreign sera—the red corpuscles of the rabbit, for example, being dissolved readily by dog's serum. Some sera have very high dissolving power, the most active thus far known being that obtained from the eel, which is correspondingly toxic. After admixture of the corpuscles and foreign serum, solution does not occur immediately. The corpuscles first run together, become clumped, or, as we now denominate the effect, agglutinated. The dissolving effect of venom upon corpuscles is also preceded by a similar agglutination, as was first shown by Mitchell and Stewart.[1]

There is much similarity in the phenomena of agglutination and of lysis as observed in blood corpuscles with the appearances seen in connection with bacteria. The Gruber-Widal reaction of agglutination, which has served so well in the diagnosis of typhoid fever and other bacterial infectious diseases, is of a similar nature. Moreover, under certain conditions solution of the agglutinated bacteria may also occur, when bacteriolysis more or less analogous to hæmolysis results. The well-known Pfeiffer phenomenon, in which cholera spirilla undergo disintegration and solution in the peritoneal cavity of the immunized guinea-pig, is the classical example of bacteriolysis.

The studies of the past two or three years upon the allied phenomena of bacteriolysis and of hæmolysis have not only demonstrated their fundamental similarity, but provided chemical explanations of the process involved.

Pfeiffer observed that the serum of immune animals caused only agglutination of the bacterial species used for immunization; he believed that for complete solution of the bacteria the mixture must be brought into the living body, and for this purpose he chose the peritoneum of the guinea-pig. Somewhat later Metschnikoff dis-

[1] Transactions of the College of Physicians of Philadelphia, 1897, 3 S. xix. p. 105.

covered that the same effect could be produced in vitro by the addition to the immune serum of a small quantity of peritoneal exudate, or even of the fresh serum of an animal. From this experiment it could be inferred that for agglutination of bacteria certain bodies were required which were in the immune serum; but for solution still other substances contained in part in fresh serum were requisite. That this second substance might also be present in the original immune serum could now be shown, and it was also demonstrated that it is of a very labile nature and quickly disappears spontaneously. The addition of fresh serum or exudate restores it. It may be destroyed by raising the temperature of the fluid to 56° C.

A great advance in our knowledge of cytolysis was made when it was discovered that immunization to blood and body cells gives rise to the production of lysins. Just as in bacterial immunization lysins for the special bacteria employed are yielded, so also are evolved analogous substances for red and white blood cells, for epithelial cells, spermatozoa, etc. Indeed, the number and variety of lysins that can be produced experimentally are limited apparently only by the number and variety of animal cells available. Blood cells of one animal may be used to produce a lysin in the body of another animal of the same species—isolysin; in another species—heterolysin; and success has in rare instances followed the re-injection of withdrawn blood, through which autolysins have been produced. Nor is the production of lysins the only result of the injections of cellular structures. Preceding the solution, clumping of the cells takes place, from which it may be concluded that agglutinins are also formed.

The factors required for producing solution of cells are similar to those for causing solution of bacteria under like conditions. Only when the lytic serum is very fresh will solution be effected; the addition, however, of peritoneal exudate of fresh normal serum to immune serum which has lost the solvent property suffices to restore it.

A consideration of the preceding facts shows that the agglutinating principle is distinct from the dissolving one. This consideration also indicates that more than one body is necessary to bring about solution either of bacteria or of animal cells.

An analysis of the phenomena suggests that at least two substances are requisite. One is stable and contains in the immune sera

(whether for bacteria or animal cells); the other is labile, and while originally contained in the immune sera, it is lost spontaneously. This latter substance is a normal constituent of the lymph and blood plasma, for it can be restored by the addition of these fluids.

Experiments conducted in a very convincing way by Ehrlich and Morgenroth indicate: (1) That a special principle is concerned in agglutination—the so-called agglutinin; and (2) that two principles are concerned in lysis. These principles are different in origin. One—that which is stable—is the product of immunization, and, on account of certain combining properties possessed by it, they call it the intermediary body.[1] The other is normally present in the body juices, but is easily destroyed by heat and tends to disappear spontaneously when the fluids are removed from the body. The latter, on account of the complemental nature of its action, they propose to call the complement.[2]

There is conclusive experimental evidence that, although the intermediary body unites first with the cells—bacterial, blood cells, etc.—this substance by itself cannot bring about solution. But after the union of this intermediary body with the cells the complement is capable of being brought into action, through this intermediation, so that solution takes place. The union of intermediate body and cells is conceived to take place through certain common combining (haptophore) groups present in the cells and in the intermediary substance; while the complement is linked through similar combining (haptophore) groups possessed by the intermediary body and itself. The intermediary body, therefore, carries two sets of combining or haptophore groups: one for the cells and the other for the complement (complementophilic group). The complement possesses, in addition to such a corresponding haptophore group, another group which exhibits fermentative properties (zymotoxic or toxophore group), through the action of which solution of cells takes place.

This conception of lysis applies not solely to that produced by immunization, but the same factors are believed to be operative in the solution of blood cells or bacteria by normal blood sera. Here

[1] Ehrlich has recently suggested the name "*ceptor*" in place of intermediary body. According to the manner of action he distinguishes "*uniceptors*" and "*amboceptors.*" Bordet calls this body "*substance sensibilicatrice;*" Metschnikoff, "*fixator;*" P. Mueller, "*copula.*"

[2] This body is called "*alexine*" by Bordet, and probably agrees in part with the body of the same name described by Buchner. Metschnikoff calls it "*cytase.*"

also an intermediary body and a complement are brought into action; the only difference being that in the one case the intermediary body is produced through artificial immunization and in the other it is present normally, but whether because of some insidious and unperceived change, similar to but slighter than artificial immunization, is not known.

It would carry us too far afield to give in detail the elaborate views of Ehrlich and his coworkers as to the origin of the intermediary bodies. Suffice it to say that they are the products of immunization by bacterial or other cells, and are believed by them to be yielded by certain constituents of cellular protoplasm within the body, designated as "lateral chain," which, through their haptophore groups, are capable of combining with the haptophore groups of protoplasmic constituents of the bacteria or the cells used for the immunization. When dealing with the toxic constitution of venom more will be said concerning this aspect of the subject.

Venom Agglutination. For the study of agglutination all the available varieties of venom were employed. Several kinds of animal blood—from the dog, rabbit, guinea-pig, sheep, ox, pig, *Necturus*, and frog—were tested. Either the blood was defibrinated or the specimen consisted of the corpuscles separated by centrifugalization and washed six times, as a rule, in 0.8 per cent. normal saline solution (washed corpuscles). The different venoms showed slight differences only in the degree of agglutination, with the exceptions of the action on the blood of *Necturus* and the frog, which are not affected in weak solutions, but show agglutination in stronger solutions (2 per cent.).

The usual method consisted in dissolving in normal saline solution dried venom in strengths ranging from 0.01 per cent. to 10 per cent.—the last that of *Crotalus adamanteus*. The phenomena of agglutination appear rapidly in favorable solutions, while in very weak solutions a delay of some minutes up to one hour may be noted. The corpuscles which come together thus slowly do not show the great modification of shape that is characteristic of those that fuse more completely and quickly. In a general way it may be said that the several varieties of dried venom with which we experimented gave, when employed in the strength of 0.5 per cent., what are to be regarded as maximal agglutinations for mammalian corpuscles. Active agglutination still takes place in 0.2 per cent.

solutions, while weaker ones either produce no change at all or show an imperfect fusion.

The morphological changes need not be described here, as these have been fully dealt with by Mitchell and Stewart.[1]

The value of the use of washed corpuscles comes especially from the fact that the succession of lytic phenomena is eliminated. Agglutination, therefore, may be studied purely. For this purpose a 5 per cent. solution of the corpuscles in normal salt solution was employed. That complete agglutination has no effect upon subsequent solution (lysis) of the corpuscles will be shown when treating of the latter phenomenon. On the other hand, distinct differences in susceptibility to agglutination have been observed. Of the mammalian blood thus far employed the red corpuscles of the rabbit may be said to be highly susceptible, while those of the guinea-pig, dog, sheep, swine, and ox are less responsive in about the order given.

The use of defibrinated blood permitted observation upon the succession of phenomena of agglutination and hæmolysis. In general it may be said that the first effect of the venom is the production of agglutination, to be followed by solution after a variable interval, depending on the kind and strength of the venom and on the temperature. There are, however, notable exceptions in that the range of the lytic activity of venoms is greater than that of the agglutinating property. Very weak solutions of venom which no longer causes agglutination may still be capable of producing solution.

Moreover, on account of the action of two sets of factors in defibrinated blood—one tending to produce agglutination and the other solution of the red corpuscles—the degree of agglutination is here less marked than in the washed cells where no lysis occurs. This difference is explained by the fact that a part of the corpuscles go into solution before agglutination can take place, and hence the extent of precipitation and fusion varies inversely with the susceptibility to lysins. As a consequence, dog's corpuscles, which are more easily hæmolyzed by venom than any others of the animal bloods tested by us, show the least degree of agglutination. The rapidity of agglutination in any case is not affected by ordinary temperatures. Hence a low temperature (0° C.) permits, even in

[1] Loc. cit.

defibrinated blood, the separation of the phenomena of lysis and those of agglutination. At this temperature defibrinated dog's blood behaves as do the washed corpuscles, the amount of precipitation being, therefore, greater than at the temperature of the room or of the thermostat.

The agglutinating power of venoms is destroyed by temperatures of 75° to 80° C. maintained for thirty minutes.

Venom Hæmolysis. Unless mention is especially made the same group of animals was employed in these studies as in the foregoing. The venom solutions varied from 5 per cent. to 0.0001 per cent., depending upon the source of the corpuscles and the variety of venom.

The venoms differ in hæmolytic power as follows: cobra most active; water moccasin, copperhead, and rattlesnake in less degree in the order named. A similar variation in susceptibility to the reaction could be distinguished in the different mammalian bloods employed. Thus dog's blood was most quickly and easily hæmolyzed and responded to the greatest dilutions; while the corpuscles of the ox were the least susceptible. The intermediate animals were in about the following order: sheep, guinea-pig, pig, and rabbit. On the other hand, the blood of *Necturus* is acted upon slightly after longer periods, and frog's blood almost not at all after equally long periods.

The extent of variation in the response of the different bloods is considerable. Very strong solutions of venom (5 per cent.) are needed to cause hæmolysis of corpuscles of the ox, but such great strengths are without action upon rabbit's corpuscles, although they are still capable of producing rapid solution of dog's or sheep's corpuscles. Taken altogether solutions averaging 0.2 per cent. of venom have proven the most favorable for bringing out the hæmolytic effect upon blood generally.

Defibrinated Blood. In making the tests with defibrinated blood uniform mixtures were employed. In all experiments 5 per cent. of blood was added to the venom solutions, and the mixtures were kept at temperatures varying from 36° to 37° C.

The differences in activity of venoms are shown by the following series in which minimal active solutions are given for several kinds of blood:

Dog's blood hæmolyzed by solutions of *Crotalus* venom 0.001 per

cent.; copperhead, 0.0005 per cent.; water moccasin, 0.0002 per cent.; cobra, 0.0001 per cent.

Sheep's blood hæmolyzed by solutions of *Crotalus* venom, 0.002 per cent.; copperhead, 0.301 per cent.

Guinea-pig's blood hæmolyzed by solutions of *Crotalus* venom, 0.002 per cent.; copperhead, 0.001 per cent.

Swine's blood hæmolyzed by solutions of *Crotalus* venom, 0.002 per cent.; copperhead, 0.001 per cent.

Rabbit's blood hæmolyzed by solutions of *Crotalus* venom, 0.005 per cent.; copperhead, 0.002 per cent.

Rabbit's blood hæmolyzed by solutions of water moccasin venom, 0.002 per cent.; cobra, 0.001 per cent.

Ox's blood hæmolyzed by solutions of *Crotalus* venom, 0.05 per cent.; copperhead, 0.02 per cent.

Effect of Heat upon Hæmolytic Power of Venoms. Temperatures of 75° to 80° C. for thirty minutes have no effect upon the hæmolytic action of any kind of venom. From 90° to 96° C. *Crotalus* venom (in solution) suffers a moderate reduction in hæmolytic power, while the remaining venoms are entirely unaffected at these temperatures. After heating to 100° C. for fifteen minutes the dissolving power of cobra, moccasin and copperhead venom in solution is slightly reduced.

Effect of Venoms upon Washed Blood Corpuscles. In no instances were the washed blood corpuscles hæmolyzed by venom. Agglutination occurs as already described. But if the separated serum is restored to each of the several kinds of blood corpuscles treated with venom, lysis takes place.

Certain important differences may be noted. Thus, if the quantity of serum added to rabbit's corpuscles exceeds the normal, quicker and more complete solution occurs than is noted in defibrinated blood. A similar but less striking action may be observed with the blood of the guinea-pig. This action depends upon the union first effected between the red corpuscles and the intermediary body of venom, the latter later combining with the introduced complement of the serum, so that solution takes place. But before taking them up another set of phenomena must be briefly considered.

Rabbit's and guinea-pig's washed blood corpuscles (hereafter termed washed corpuscles) are quickly dissolved by fresh dog's serum. Dog's corpuscles are but little acted upon by fresh rab-

bit's serum and not at all by guinea-pig's serum. Rabbit's and guinea-pig's sera are about equally hæmolytic for each other's corpuscles. *Necturus*' serum is highly hæmolytic for rabbit's, dog's, and guinea-pig's corpuscles. Frog's serum is less destructive for the mammalian corpuscles mentioned than that of *Necturus*, but is still very active. *Necturus*' and frog's sera are slightly and equally active on each other's corpuscles.

This dissolving action is not noted at freezing temperatures. If, therefore, washed corpuscles which have been treated with serum for thirty minutes at zero temperature are separated by centrifugalization or precipitation, the complement in the serum is unaffected, while the intermediary body will be found to have been removed from the serum by the corpuscles. In this way the complement for a particular species of corpuscle, free from the intermediary body, can be obtained. The addition of such complement containing serum to venomized washed corpuscles of the same species brings about hæmolysis, while the addition of fresh washed corpuscles to the treated serum, from which the intermediary body for them has been removed, is unattended by solution.

The action of complements, freed from any intermediary body by this means, upon venomized corpuscles of different species has also been studied. The results are of interest. The procedure is as follows: Let us suppose that it is desired to test the effects of rabbit's serum upon venomized dog's corpuscles. The rabbit's serum is first treated with washed dog's corpuscles in the cold to withdraw all combining intermediary bodies; the clear serum having been separated, is now added to the venomized corpuscles, when solution of a slow and limited nature occurs.

Controls for these experiments were made in the following manner: Any serum treated with alien corpuscles at zero temperature, and then separated from the corpuscles by centrifugalization, has become inactive for this kind of fresh washed corpuscles (tested for dog's, guinea-pig's, rabbit's, and *Necturus*' corpuscles) and at higher temperatures. However, if to the inactive mixture the same variety of serum heated to 58° C. is added (this serum containing intermediary body, but without complement) solution takes place.

The degree of interaction of different species of sera minus intermediary bodies upon different species of venomized washed corpuscles is shown by the following series, in which the copperhead venom

is used throughout: 1 c.c. of 0.2 per cent. solution of venom is mixed with 0.05 c.c. of washed corpuscles and 0.5 c.c. of complement, with these results:

Dog's corpuscles and rabbit's complement = slow and imperfect hæmolysis.

Dog's corpuscles and guinea-pig's complement = slight hæmolysis, more marked than preceding.

Rabbit's corpuscles and dog's complement = rapid and imperfect hæmolysis.

Rabbit's corpuscles and guinea-pig's complement = weak and imperfect hæmolysis.

Guinea-pig's corpuscles and dog's complement = rapid and imperfect hæmolysis.

Guinea-pig's corpuscles and rabbit's complement = slow and imperfect hæmolysis.

Dog's corpuscles and *Necturus*' complement = slight and imperfect hæmolysis.

Guinea-pig corpuscles and *Necturus*' complement = no action.

Rabbit's corpuscles and *Necturus*' complement = no action.

Venom solution treated with dog's, rabbit's, and guinea-pig's washed corpuscles in succession gives up to each a part of its intermediary bodies. No one kind of corpuscles is capable of fixing the entire content of intermediary bodies. The supernatant fluid probably contains still other intermediary bodies capable of fixation by still other corpuscles. If to the several kinds of venomized corpuscles here mentioned different complements are added, then, as shown in the above table, lysis will or will not take place, depending on the nature of the complement employed; but so long as the complement is foreign to the corpuscles it never causes complete solution.

From these results the following conclusions are warranted: (1) Venom contains several or many intermediate bodies; (2) these bodies show specific affinities for certain complements. In addition to this there is evidence that the many susceptible corpuscles contain, besides the specific haptaphore groups for intermediary bodies, certain common haptophore groups which are shared, perhaps, by all vulnerable corpuscles.

Combined Action of Venom and Ricin. *Relation of Agglutination and Hæmolysis.* Agglutination produced by lysis does

not affect lysis. But, on the other hand, when lysis takes place quickly agglutination may fail or may appear imperfectly. The principles causing the two phenomena are distinct in the manner of combination and in action. That the agglutinative and the lytic principles are different is now proven; and there is evidence that they act upon different constituents of the red cells. Thus, if ricin, a strong agglutinator, is permitted to act upon red corpuscles for periods under thirty minutes, then upon the addition of venom lysis ensues in about the average time and proceeds normally. If, however, the ricin has acted for two or more hours, then solution by venom still takes place, but the stroma of the corpuscles remains in the bottom of the test tube as a white conglutinated mass. From this it appears that agglutination brings about a kind of coagulation of the stroma, from which, through the action of the hæmolysis in venom, hæmoglobin has been released. Ricin is without action upon venom itself, and, conversely, ricin is equally unaffected by venom.

Venom Leucolysis. In the blood snake venom causes destruction of the leucocytes as well as of the red cells. In order to ensure a more accurate study of its action upon the white blood cells these were obtained in larger quantities and without admixture of red cells by injecting positively chemotactic substances into the pleural and peritoneal cavities of the rabbit. For this purpose cultures of *B. megatherium* killed by heat were injected into the pleural cavity and sterile bouillon into the peritoneum.

From eighteen to twenty-four hours after the introduction of *B. megatherium* into the pleural cavity fluid rich in leucocytes may be withdrawn by means of capillary tubes without sacrificing the animal. The same procedure employed twenty-four hours after the injection of bouillon yielded a fluid less rich in leucocytes, and consequently this second method was not extensively employed.

The leucocytes in the fluids thus obtained could be separated according to size and granulation into lymphocytes (20 to 25 per cent. of the total leucocytes), finely granular, medium-sized cells (60 per cent.), larger non-granular cells (3 per cent.), still larger, irregular, and coarsely granular cells (4 per cent.), and others again somewhat smaller, but showing very coarse granules (6 per cent.). The susceptibility to the destructive effects of venom varied somewhat for the different cells. Those of the largest size with coarse

granules are most quickly affected; next to these come the fine varieties, the lymphocytes, showing the least injury of all.

In studying the changes taking place in the leucocytes under the influence of venom a warm stage (37° C.) was used, the edges of the cover glasses having first been sealed with vaseline. The venom solutions varied from 10 per cent. to 0.002 per cent. The weakest effective solution was that of cobra venom, 0.002 per cent., whereas in the case of the rattlesnake and of the moccasin, 0.002 and 0.005 per cent., respectively, caused definite changes.

Only the granular cells showed motility. Weak, active solutions are without immediate effect on motion, but begin to manifest an inhibiting action after about an hour, the controls being still motile at the end of two hours or longer. After the motility ceases the cells in general, except the lymphocytes, show increased granulation, due to the appearance of coarser and more numerous granules in the protoplasm, the nuclei coincidently becoming more distinct. After six hours the majority of the largest granular cells have already disintegrated, the nuclei having been liberated. After twenty-four hours most of the medium-sized granular cells have suffered disintegration, while the lymphocytes show but slight and inconspicuous changes. Stronger solutions, varying from 0.2 per cent. to 10 per cent., cause instant cessation of motility and rapid agglutination, without any distinction of variety of cells. Within five to thirty minutes thereafter dissolution sets in, affecting first the largest, then the medium-sized cells, and finally the small lymphocytes.

There are variations in the activities of the several venoms and in the completeness of solution of the cells. Rattlesnake venom is far less active than that of the cobra. Thus, in 2 per cent. solutions cobra venom causes complete solution in thirty minutes, while that of the rattlesnake requires two hours to bring about the same result.

The effects upon washed leucocytes differ from those described, in that venom solutions cause agglutination, but with the production of only very slight lysis.

Are the Hæmolysins (Erythrolysins) Identical with Leucolysins? Copperhead venom (1 mg in 4 c.c. of normal saline) was treated with washed rabbit's red corpuscles at the thermostat temperature for thirty minutes, until the supernatant fluid, after centrifugalization, was without action upon defibrinated rabbit's blood. This

solution, when brought into contact with leucocytic fluid, was without agglutinating action upon the cells while still causing their solution, in about thirty minutes. On the other hand, the parallel experiment in which venom solution was treated with washed leucocytes yielded a fluid still active for defibrinated blood.

The conclusions from these experiments are as follows:

1. Venom contains principles which are agglutinating and dissolving for white blood corpuscles.

2. The agglutinating principles may be identical both for white and red cells.

3. The dissolving principle for leucocytes is distinct from that for red cells.

4. In order that solution of venomized leucocytes shall occur, a complement containing fluid is required.

5. The several varieties of white cells of the rabbit's blood show different susceptibilities to the action of venom.

Venom Toxicity. For the study of the toxic principles copperhead venom was chiefly employed. The animal selected for these experiments was the guinea-pig. The method of procedure was the following: We first determined, for the particular sample of venom to be used, the minimal lethal dose. This was found to be 0.3 mg. for a pig weighing from 250 to 300 grammes, death resulting within twenty-four hours. A dose of 0.6 mg. caused death in from two to three hours, and of 0.9 mg. in from thirty to forty-five minutes.

Our especial purpose was the determination of the existence of neutralizing substances for venom in the tissues of the body. The following tissues and organs were employed: brain, liver, spleen, kidney, voluntary muscle, adrenal gland, and blood. For this purpose the tissues were first washed in tepid, sterile, normal saline, and a weighed quantity (two grammes) was taken. This was triturated in a sterile mortar and mixed in test tubes with three times the minimal lethal dose (M. L. D.) of venom. The mixture was now placed in the thermostat, where it remained for one hour. It was then centrifugalized and the supernatant fluid was injected into the guinea-pigs. In the course of the experiment the original volume of the venom solution suffered a loss amounting on an average to one-third of the whole volume. There should, therefore, after this subtraction remain behind at least twice the minimal lethal dose ($2 \times$ M. L. D.).

In the case of the blood, washed corpuscles were employed in excess, the other steps remaining the same as in the previous experiments.

The results of these experiments are as follows: control, dead in forty-five minutes; brain, dead in nineteen hours; blood, dead in three hours and fifty minutes; adrenals, dead in two hours and thirty-five minutes; spleen, dead in two hours and ten minutes; liver, dead in one hour and thirty minutes; kidney, dead in one hour and fifty-five minutes; muscles, dead in one hour and thirty minutes.

In the next experiment 2 M. L. D. of venom were employed. The control died in five hours. The animals receiving the venom solution treated with the organs, etc., reacted as follows: brain, survived; blood, dead in twenty-eight hours; liver, dead in nineteen hours.

Relation of Neurotoxic to Hæmolytic Principle. That these two principles are distinct is rendered probable by the effects of washed red corpuscles and of brain tissue, respectively, upon the toxicity of venom. Blood corpuscles remove little or perhaps none of the toxic constituent that brain cells do away with *in toto*. The proof of difference can, however, be brought in another way: Four M. L. D. of venom were treated with an excess of red corpuscles and the supernatant fluid was injected into a guinea-pig; death ensued in thirty minutes. The same quantity of venom having been treated with four grammes of brain emulsion, the supernatant fluid injected into a guinea-pig caused death in forty-eight hours. The experiments in which 9 M. L. D. of venom were used resulted (1) in the case of the blood in death in twenty-five minutes, and (2) in the case of the brain (seven grammes of brain having been employed) in twenty-five hours.

The supernatant fluid from the brain emulsion was strongly agglutinating and hæmolytic for defibrinated blood, while that from the washed corpuscles had lost all these properties. The supernatant fluid from the brain emulsion, when treated with an excess of washed corpuscles, re-centrifugalized, and the fluid then injected is non-toxic for guinea-pigs.

These experiments show: (1) That the neurotoxic and hæmolytic principles are physiologically distinct; (2) that while the chief toxic constituent unites with the nerve cells, in multiple M. L. D., from

which the neurotoxic principle has been removed a quantity of hæmolysin may be contained sufficient to bring about fatal intoxication.

These results are in keeping with the views expressed by Ehrlich and supported by Wassermann and Takaki's experiments on the fixative power of cells for certain groups of toxic substances. They tend, therefore, to support the hypothetical considerations of Ehrlich on which he bases his well-known lateral chain theory of immunity. Expressed in the terms of this hypothesis, brain cells may be said to contain the receptors for the neurotoxic constituent of venom, whereas blood cells furnish the receptors for the hæmolytic principle; these receptors are distinct and specific, and are not contained to any considerable amount, and perhaps not at all in the liver and kidney cells, and, if at all, in small quantity only in adrenal cells. Walter Myers found that the adrenal cortex possessed a certain combining power for cobra venom, most marked in mammals (sheep) in which the cortex of the organ is well developed. He also observed little effect from the adrenal of the guinea-pig.

Effects of Venom upon Bactericidal Properties of Blood Serum. The animals employed were the dog, rabbit, and *Necturus;* the venoms belonged to the cobra, moccasin, copperhead, and rattlesnake, and the bacteria were *B. typhi*, *B. coli*, and *B. anthracis.* The method consisted in (1) introducing venom into the animal and drawing the blood from the femoral artery into sterile Nuttall bulbs; (2) permitting the blood from normal animals to enter Nuttall bulbs in which the venom solution was contained; (3) admixture of the venom in sterile solution (heated for four days to 56° to 60° C.) with separated normal serum.[1]

The bactericidal effects of the normal sera were first established. Rabbit's serum is highly destructive for *B. typhi* and *B. anthracis*, and least for *B. coli.* Dog's serum is highly destructive for *B. typhi. Necturus'* serum is also very destructive for *B. typhi* and *B. coli.* It is without marked effect on *B. anthracis.*

Serum Venomized in Vivo. Cobra venom was most active. Blood from rabbits which had received 10 mg., taken fifty-seven

[1] In order to determine whether any effect is produced on the growth of bacteria by the presence of venom in culture media, varying small quantities of venom were added to nutrient agar-agar. The bacteria—*B. anthracis*, *B. coli*, and *B. typhi*—underwent rapid involution and exhibited marked plasmolysis as compared with control tubes of the same organism.

minutes after the injection, showed great loss of bactericidal properties.

EXPERIMENT LXXI.—1 c c. venomized serum employed.

	B. anthracis.	B. coli.	B. typhi.
Immediate . . .	1841	4,254	7,152
After 1 hour . .	767	3,125	4,130
After 3 hours . .	2488	13,460	4,320
After 6 hours . .	innumerable	innumerable	17,280
After 24 hours . .	innumerable	innumerable	innumerable

The controls for this experiment showed complete destruction of all bacteria, or, as in a few experiments, of all except *B. coli*, which showed considerable diminution until six hours, when increase began.

EXPERIMENT LXX.—30 mg. rattlesnake venom injected; blood taken after forty-five minutes. 1 c.c. venomized serum employed.

	B. anthracis.	B. coli.	B. typhi.
Immediate . . .	838	9940	5750
1 hour . . .	756	6240	3654
3 hours . . .	2930	increase	6219
6 hours . . .	increase	innumerable	about 10,000
24 hours . . .	innumerable	innumerable	innumerable

Blood Mixed with Venom in Vitro. In this series rabbits only were employed. The venom solutions were placed in Nuttall's bulbs, and the blood from the femoral artery was permitted to stream into them. In each experiment 6 mg. of venom were mixed with 20 to 30 c.c. of blood. Coagulation was very slow or completely inhibited, and the serum was obtained when necessary by centrifugalization. It invariably contained hæmoglobin.

EXPERIMENT LXXIII.—1 c.c. of venomized serum employed.

	B. anthracis.	B. coli.	B. typhi.
Immediate . . .	1,644	4,580	4,085
1 hour . . .	2,080	10,760	4,870
3 hours . . .	18,930	149,740	24,730
6 hours . . .	innumerable	innumerable	innumerable

EXPERIMENT LXXII.—1 c.c. venomized serum employed.

	B. anthracis.	B. coli.	B. typhi.
Immediate . . .	736	3,720	1275
1 hour . . .	407	2,340	920
3 hours . . .	860	22,210	8720
6 hours . . .	5220	innumerable	innumerable
24 hours . . .	innumerable		

This series of experiments may be open to the criticism that the increased nutritive value of the serum, because of the hæmoglobin present, may have been the cause of the effects noted; as a control, therefore, peptone was added to the serum in the proportion of 6 mg. of peptone to 20 c.c. of serum.

EXPERIMENT LXXX.—Peptone added to rabbit's serum; 1 c.c. employed.

	B. anthracis.	B. coli.	B. typhi.
Immediate	1043	5120	7430
1 hour	193	2240	1534
3 hours	87	578	71
6 hours	22	520	262
24 hours	0	innumerable	about 20,000

From this experiment it follows that improvement in nutritive value reduces bactericidal effect, but in far less amount than is noted in the parallel case of venom.

That the nutritive change is unimportant is shown by the first experiments, in which the poisoning was done in vitro, and also by those to follow in which venom was added directly to the separated serum.

EXPERIMENT LXXXV.—Rabbit serum (1 c.c.) with rattlesnake venom (1 mg.).

	B. anthracis.	B. coli.	B. typhi.
Immediate	745	3,990	5,430
1 hour	594	4,667	3,136
3 hours	4486	12,120	43,430
6 hours	about 100,000	innumerable	about 200,000
24 hours	innumerable	....	innumerable

EXPERIMENT LXXXII.—Dog's serum (1 c.c.) with copperhead venom.

	Venom, 6 mg. B. typhi.	Venom, 1 mg. B. typhi.	Control; plain serum. B. typhi.
Immediate	8,860	3,572	5808
1 hour	21,120	6,525	584
3 hours	65,250	14,950	184
6 hours	innumerable	innumerable	92
24 hours	....	....	0

In order to determine the least quantity of venom required to remove the bactericidal properties of the serum, varying quantities

of copperhead venom were employed. Dog's serum was chosen with *B. typhi.* In each case 1 c.c. of serum was used.

EXPERIMENT LXXXVII (*a*).—1 c.c. dog's serum and varying amounts of copperhead venom.

Venom.	1-2 mg.	1-5 mg.	1-10 mg.	1-20 mg.	1-50 mg.
Immediate	5,970	3,070	4,290	4,940	3350
1 hour	6,240	3,960	1,830	2,620	920
3 hours	12,810	10,000	6,730	1,350	593
6 hours	innum.	100,000	13,140	172	15
24 hours	....	innum.	innum.	10,000	0

From this it may be concluded that the specimen of venom employed by us destroys the bactericidal properties of dog's serum when added in the proportion of 1.20 mg. of venom to 1 c.c. of serum, and that 1.50 mg. in the same quantity of serum is practically without action.

In view of these positive results the partial inaction of venom upon *Necturus* serum is both remarkable and important.

EXPERIMENT CII.—1 c.c. *Necturus* serum employed.

	B. anthracis.	B. coli.	B. typhi.
Immediate	4,215	5127	8350
1 hour	6,950	453	233
3 hours	18,340	84	12
6 hours	50,170	4	0
24 hours	innumerable	0	

EXPERIMENT CIII.—Same as above and copperhead venom 6 mg.

	B. coli.	B. typhi.
Immediate	5237	3846
1 hour	615	394
3 hours	95	11
6 hours	180	2
24 hours	2950	3105

Control. *Necturus* serum in 1 c.c. and peptone 6 mg.

	B. coli.	B. typhi.
Immediate	9270	4530
1 hour	3810	577
3 hours	632	92
6 hours	78	2
24 hours	1850	927

EXPERIMENT CV.—*Necturus* serum 1 c.c. and copperhead venom 1 mg.

	B. coli.	B. typhi
Immediate	6240	7360
1 hour	1170	833
3 hours	583	96
6 hours	25	13
24 hours	0	0

It may be remarked that *Necturus* is highly refractory to venom. An animal weighing 250 grammes received without effect 0.05 gramme of venom, equivalent to 160 M. L. D. for the guinea-pig.

The effect of heat upon venom in relation to its action upon the bactericidal properties is of interest. For this purpose cobra, rattlesnake, moccasin, and copperhead venoms were studied. Temperatures varying from 75° to 90° C. were employed, and the heated venoms mixed with the streaming blood in Nuttall's bulbs and with the separated serum. The venoms were kept at the lower temperature (75°) for thirty and the higher (90°) for fifteen minutes.

The heated venom acts just as the unheated, except in the case of rattlesnake venom, the effect of which is somewhat diminished at the higher temperature (90° C.).

The Mechanism of the Action of Venom upon Serum. That the bactericidal action of serum depends upon the intermediary body and complement seems established. That the influence of venom upon this property does not depend upon changes in the nutritive value of the serum the foregoing experiments prove conclusively. It is, therefore, possible that venom acts injuriously upon the intermediary body or the complement, or upon both bodies at the same time. The complement is destroyed by heating serum to 56° to 58° C. —a temperature which does not affect the intermediary body.

EXPERIMENT XCVIII.—To test effect of venom on the intermediary body: (1) Copperhead venom, 1-20 mg.; rabbit's serum, 1 c.c., and rabbit's serum heated to 58° C., 1 c.c. (2) Control; rabbit's serum heated to 56° C.

	(1) B. typhi.	(2) B. typhi.
Immediate	4,990	5,320
1 hour	5,800	7,800
3 hours	18,840	12,400
6 hours	innumerable	innumerable

EXPERIMENT XCIX.—To test effect on the intermediary body: (1) Copperhead venom, 1 10 mg.; dog's serum, 1 c.c.; dog's serum heated to 56° C., 1 c.c. (2) Control; serum heated to 56° C.

	(1) B. typhi.	B. typhi.
Immediate	2,270	3,440
1 hour	2,680	3,950
3 hours	71,950	12,800
6 hours	innumerable	innumerable

From these experiments the conclusions can be drawn that venom is without action upon the intermediary body contained in dog's and rabbit's serum.

The next experiment was to determine whether any action was exerted by venom upon the complements of these sera. For the purpose of obtaining the serum complement free from the intermediary body the rabbit was treated with dog's serum heated to 56° C. In this way the anti-intermediary body was obtained, which when heated to 56° C. (to remove rabbit's complement) and added to fresh dog's serum neutralized the action of the latter upon rabbit's corpuscles.

From this it could be concluded that the intermediary body of the dog's serum was neutralized by the anti-intermediary body contained in the immunized rabbit's serum, leaving behind the pure dog's complement in the fluid.

Experiment XCIX (*a*).—Action on complement: (1) Fresh dog's serum, 1 c.c.; copperhead venom, 1-10 mg., and dog's complement, 1 c.c.[1] (2) Control; dog's serum, 1 c.c., and 1-10 mg. venom.

	(1) B. typhi.	(2) B. typhi.
Immediate	5270	4,360
1 hour	930	5,980
3 hours	28	25,410
6 hours	15	innumerable
24 hours	0	

A similar experiment in which anti-intermediary body for rabbit's serum was produced in the guinea-pig gave practically identical results, except that when 1-10 mg. of venom was employed the neutralizing effect of this quantity on the complement was also exerted upon the second quantity of complement added.

[1] To obtain these complements fresh dog's or rabbit's serum was treated with rabbit's or guinea-pig's serum containing the anti-intermediary body, which was heated to 56° C.

EXPERIMENT XCVIII (*a*).—Copperhead venom; fresh rabbit's serum, 1 c.c., and rabbit's complement, 1 c.c.

	B. typhi. 1-10 mg. venom.	B. typhi. 1-20 mg. venom.
Immediate	4590	3280
1 hour	3740	1360
3 hours	1850	730
6 hours	4900	110
24 hours	innumerable	0

From the experiments under the present heading the following conclusions are warranted:

1. All venoms when used in suitable quantities destroy the bactericidal properties of many normal blood sera.

2. The manner of this destruction consists in the fixation of the serum complements by the venoms.

3. Venoms have no action upon the intermediary bodies of serum.

4. If the venom is incapable of uniting with the serum complement (*Necturus*), then the original bactericidal properties remain unaffected by the presence of the venom.

Effects of Antivenin on Hæmolysis and Bacteriolysis. Through the kindness of Dr. McFarland we secured a small vial of Calmette's antivenin. This was used to test the restraining action upon venom hæmolysis and venom antibacteriolysis. The antivenin was first proven to be non-hæmolytic for rabbit's corpuscles and to improve slightly the nutritive value of fresh rabbit's serum.

Erythrolysis by cobra venom on rabbit's corpuscles is prevented if neutralization by antivenin is effected. Thus, 2 mg. of venom plus 1 c.c. of antivenin is still lytic, although action is retarded; 1.5 mg. of venom plus 1 c.c. of antivenin caused slight hæmolysis after twenty-four hours, while 1 mg. plus 1 c.c. was without action.

In the case of rattlesnake venom 1 c.c. of antivenin neutralized 3 mg. of the poison.

Leucolysis was affected in approximately the same degree as in the case of erythrolysis.

The effect on bacteriolysis is equally marked. When cobra or rattlesnake venom is treated with a neutralizing quantity of antivenin and fresh serum is added the resulting fluid behaves in a manner similar to that of the control mixture of normal fresh serum and antivenin.

Antivenin, therefore, neutralizes venom and removes both the hæmolytic and the antibacteriolytic actions.

DISCUSSION.

Dr. Spiller: I was wondering, when Dr. Flexner spoke of the action of the poison on the nervous system, whether it was upon the nerve cells or nerve fibres, the nervous substance or medullary sheaths of the brain substance. We know that the medullary sheath breaks up readily under the effects of poisons.

Dr. Edsall: Of further interest in connection with Dr. Spiller's question is the effect of the neurotoxins upon the fatty neuroma in the nerve structure. We know that narcotics exert their poisonous influence upon the fatty structure. If this be absent the poisonous effect is not produced. In this connection we are also drawn pretty close to knowing what the intermediate body is, since it has been demonstrated that in the absence of the cholesterin the poisonous effects upon the blood cannot be produced.

Dr. Flexner closes: In reply to the questions raised by Drs. Spiller and Edsall, I would say, first, that the evidence which we now possess points to the cell body as supplying antitoxic substances. The manner in which it is brought about is conceived to be something like the following: Toxic substances capable of producing antisubstances possess two combining groups. One, called the haptophore group, unites with the corresponding constituent of the cell which Ehrlich calls side or lateral chain; the other group is toxic in nature, bringing about injury of the cell constituents with which it is united. The regeneration of the injured portion of the cell is, in keeping with a general pathological law, excessive. The overproduced material being cast off into the blood stream, furnishes the antisubstances. These antisubstances thus circulating in the blood constitute neutralizing agents, antitoxins, etc., with which we are all familiar. I would next say that it is now proven that neutralization of hæmolytic agents may be effected in the blood through the agency of non-living constituents, such, for example, as cholesterin. Thus, saponin, which is hæmolytic, brings about this effect, because of its affinity for cholesterin in the red corpuscles. If it is supplied with cholesterin outside it will then fail to attack the corpuscles.

Dr. Noguchi, in my laboratory, has recently made experiments which tend to show that the antihæmolytic effects of cholesterin and lecithin may be observed with a large number of hæmolytic bodies.

A REMARKABLE CASE OF COMA, APPARENTLY DUE TO ACID INTOXICATION SUI GENERIS.

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(From the service of Professor Alfred Stengel.)

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The intoxication which occurs in diabetes and the coma in which this disease frequently ends were long looked upon as being peculiar to this particular affection, both in clinical characteristics and in etiology. It has, however, been known for years that certain other grave chronic diseases—especially carcinoma and severe anæmias—sometimes exhibit signs of an intoxication which has the same peculiar features as that seen in diabetes, and in rare instances terminate in coma closely resembling diabetic coma; and in some acute conditions, particularly acute infectious diseases, mild intoxication of the same form is not uncommon, and a coma with the same clinical characteristics and with marked evidences of the same form of poisoning has been repeatedly, though quite rarely, observed. In all these cases a severe and well-recognized general disease is evidently the primary condition, and the intoxication causing the coma is quite as evidently the result; hence, while the coma may imperil the patient's life or actually take life, it is clearly a secondary condition, and the reason for the occurrence of intoxication is readily found. In another small group of cases, however, general disease was either absent or insignificant, and yet symptoms of a severe intoxication, which exhibited the same characteristics, appeared, even advanced to the occurrence of coma, and death has occurred in such

cases, anatomical changes sufficient to explain the fatal issue being absent.

The marked clinical characteristics of this form of intoxication, whether the primary disease be diabetes or some other condition, are usually drowsiness, stupor, or coma—at times preceded by nervous excitement, and even convulsions—peculiar deep respirations, reduction of temperature, an odor of acetone, and the presence of acetone, diacetic acid, and oxybutyric acid in the urine. It is now recognized that this form of intoxication is due to an excess of acids; and those cases which show an absence of a primary general disease of such a character as to offer a fair explanation of the occurrence of intoxication are classed under the term acid intoxication sui generis, or cryptogenic acid intoxication.

Acid intoxication has been shown to be chiefly the result of the decomposition of the fats of either the food or the tissues, or both; though it can scarcely be doubted that proteins play some part in its production. That acid intoxication is likely to occur in diabetes is, therefore, readily understood; for in this disease patients necessarily take large amounts of fats and proteins, and the digestive organs and the tissues are constantly required to deal with wholly unusual and abnormal amounts of these foods. Then, too, in many cases, the patient is certainly breaking down considerable amounts of his body tissues at the time of the onset of coma, and is intoxicating himself through this excessive tissue destruction, though the recent work of Magnus-Levy and others has shown that excessive tissue breakdown is by no means so constant an accompaniment of diabetic coma as it was once thought to be. The main reasons that acid intoxication occasionally occurs in other severe chronic diseases are fairly clear, for such patients are frequently breaking down tissue at an abnormal rate, and their oxidative processes are often subnormal; they are, for the latter reason, unable to oxidize the acids to harmless products, and are, therefore, more readily subject to intoxication than are those persons whose oxidative processes are active. In acute infectious diseases and similar states the conditions do not seem quite so clear, but possible sources of such an intoxication may readily be found in the suboxidation and gastro-intestinal disturbance often attending such diseases. Indeed, in all the con-

ditions mentioned there are likely to be gastro-intestinal disturbances which may result in the formation and absorption of large amounts of acids or acid-producing substances; there is always some form of metabolic disturbance which may readily lead to the formation of abnormal amounts of acids, or interfere with the proper oxidation of those formed; and in diabetes in particular, the character of the food is strongly conducive to acid intoxication.

In so-called acid intoxication sui generis the occurrence of the poisoning is much less easily understood. The evidences of general disease are lacking, and even the symptoms referable to the gastro-intestinal tract may be comparatively slight; and yet the symptoms of acid intoxication may be severe and the chemical evidences of its presence pronounced. This lack of apparent source of the intoxication has led to some skepticism as to the correctness of the conclusions drawn in the cases reported, and, since severe cases are rarely observed, acid intoxication of this variety receives but little discussion. Indeed, many clinicians seem to doubt the existence of such a clinical entity.

That it does exist is, however, satisfactorily established by a considerable series of recorded cases, in which symptoms that are known to be characteristic of acid intoxication—whether this be produced by experiment or disease—occurred, together with the urinary evidences of such an intoxication (the presence of large amounts of oxybutyric acid, diacetic acid, or acetone); in which also the symptoms of intoxication ran a course parallel with the amounts of acetone and diacetic acid, or of oxybutyric acid, in the urine; and in which, further, the evidences of other kinds of intoxication or other sources of intoxication were absent.

The cases may be grouped into three general classes:

1. Mild acetonuria is not uncommonly found in gastro-intestinal disturbance, both when disorder of the digestive tract is the main condition present, and when this is secondary to some other disease. There are, in this class of cases, often no other notable signs of any form of intoxication; or, if there is other evidence of intoxication, there seems to be no close relation between the symptoms which it presents and the acetonuria, and the intoxication does not show the characteristics of acid intoxication. In cases of this kind there is

no reason to consider the acetonuria as being of much importance. It certainly indicates the existence of some degree of acid intoxication, but it is unquestionably mild, and is a secondary matter.

2. In another group of cases marked acetonuria occurs and is often accompanied by diaceturia; and, in a number of instances, considerable quantities of oxybutyric acid have been found. The distinctive symptoms of acid intoxication were, however, not present. Gastro-intestinal disturbance has usually been present in these cases, as in those previously mentioned. Sometimes it was associated with evidences of marked irritation of the nervous system or with psychic disturbances; sometimes these nervous symptoms were absent; in some of the cases severe psychic disturbance or other nervous symptoms were present, without notable gastro-intestinal disorder; and, finally, in some of the cases there were signs of other diseases—more particularly of nephritis—in which other forms of intoxication occur. The intensity of the symptoms and of the reactions for acetone and diacetic acid often ran fairly parallel courses, and with the disappearance of the symptoms of poisoning the acetonuria and diaceturia vanished more or less completely. In these cases there were, then, evidences of decided acid intoxication; but the more characteristic symptoms of acid intoxication were absent, symptoms that are not seen in definite examples of acid intoxication were prominent, and in some cases intoxication of another kind was almost certainly present, and was probably the main cause of the symptoms. Hence, while we are justified in considering that acid intoxication was present in those cases, and that it probably had a distinctive share in the production of symptoms, we must believe that it was not by any means the sole cause of the symptoms. In many of the cases it was almost certainly not even a very important cause; in some it seems, on the contrary, to have been of decided importance, but in all the conditions were mixed, and these cases were not pure instances of acid intoxication. Frequently, however, treatment of the acid intoxication would undoubtedly be wise in these cases.

3. In still another group, however, there were very marked urinary evidences of acid intoxication, and the symptoms more or less closely approached those seen in the condition which is recognized to be acid intoxication—namely, diabetic coma and the stages pre-

ceding coma. The symptoms also increased and decreased with corresponding changes in the urinary evidences of acid intoxication, and other forms of intoxication were apparently absent. The most notable examples of such cases have been reported by Lorenz, Litten, and Kraus.

In Litten's series, for instance, there are five cases, two of them in children and three in adults, in which, after several days of digestive disturbance, the patients first exhibited nervous depression with excitability, headache, and sleeplessness, followed by increasing stupor, and finally by partial coma. There was a strong odor of acetone, and the urine gave a marked ferric-chloride reaction for diacetic acid. These conditions persisted for several days, when the acetone and diacetic acid and the symptoms of intoxication gradually disappeared together. Albumin and casts were absent; there were no symptoms of uræmia, and no evidence of organic disease other than the digestive disturbance.

Kraus reported two fatal cases. In the first, an acute attack of digestive disturbance, associated with acetonuria, was accompanied by signs of retrobulbar neuritis and of meningeal irritation. The latter signs disappeared, but the changes in the optic papilla persisted. No further observations of the patient were made until five years later, when she was readmitted. The intraocular changes were still present, but she had, throughout the five years, been free from other signs of cerebral disease. She was again suffering from an acute attack of gastro-enteritis, without determinable cause, and, after this had been continued for two weeks, evidences of meningeal irritation again appeared. As the symptoms became more pronounced an odor of acetone was observed, coma came on, and death followed. The urine contained no sugar; there were traces of albumin, and large amounts of acetone and diacetic acid and oxybutyric acid were present. An autopsy could not be made, and it was not known whether any cerebral affection was present.

In the second case, a woman, whose eyesight had previously been good, complained of visual disturbance. This continued for a week, when her eyes were examined and evidences of retrobulbar neuritis were found. Albumin and sugar were absent from the urine. It is not stated whether gastro-intestinal symptoms were present or

not. The next day she was very stupid and the eye changes had increased. On the following day the latter were still more marked, and the patient was evidently in extremis. She died the following day. Autopsy showed no intracranial lesions. The heart and aorta were small; there was gastro-intestinal catarrh. The urine on the day of death showed 2.5 per cent. of oxybutyric acid.

Kraus, who gives a very able review of the literature, concludes that these two non-diabetic persons died of acid intoxication of intestinal origin. He refers to the fact that gastro-intestinal disturbances are occasionally present in acid intoxication, whether this be of a cryptogenic, infectious, carcinomatous, or diabetic origin, and thinks that one must admit that acid intoxication may be due to digestive disturbances, and must also consider the possibility that all forms of acid intoxication are actually accidental intestinal intoxications. He insists, however, that even if the intestinal tract were determined to be the ultimate source of the intoxication, we should not be justified in considering that the disturbance of intestinal function, of itself and alone, produces the intoxication with acetone and acids of the oxybutyric type; the appearance of the acids and the digestive disturbance may much more properly be considered to be evidences of a complex nutritional disturbance, depending upon intestinal derangement. Nevertheless, Kraus considers the diagnostic value of the acetone and the acids unquestionable.

This general statement of the literature concerning the question is sufficient to bring out the important points in a case which has recently been under my observation, the main features of which were as follows:

A man, apparently in fairly good health, was suddenly overcome by vertigo, followed by prolonged coma. The coma lasted about ten hours, during which time the patient was given alkaline transfusions. He exhibited during this time the symptoms and the urinary signs of acid intoxication. He then rapidly recovered, and subsequently remained perfectly well, the symptoms as well as the urinary signs of the acid intoxication disappearing coincidently with his improvement. The signs of diabetes were absent at all times.

In detail the case was as follows:

A. B., a milkman, aged sixty-three years, was admitted to Dr. Stengel's service in the University Hospital at 8.30 A.M., November 27, 1900. The history, as afterward obtained from the family and the patient himself, was wholly negative as to any condition of interest in the immediate members of the family or in the collateral branches. The man had been a milkman all his life. He had always been active. He had habitually used small amounts of alcohol (two or three drinks of whiskey a day), but persistent investigation failed to reveal a history of anything approaching intemperance. He had no history of venereal disease. He had had some diseases of childhood; which, he did not remember. He had otherwise been healthy all his life, with the exception of a brief attack, twelve years before admission, in which he had had some pain in the back and scanty urine. At that time he had been told that he had Bright's disease; but he had had no œdema and no other symptoms that he could remember, and had no recollection of having ever had his urine examined. The symptoms passed off quickly under treatment. Recently he had felt perfectly well, excepting for occasional attacks of indigestion, which consisted almost solely of nausea, particularly before breakfast, and some fulness and discomfort after taking food. He was habitually constipated.

The immediate history of the attack is as follows: On the day before he had been in his usual condition. On the morning of the 27th he had risen at 6 o'clock, feeling nauseated and rather weak, and with a general sense of being ill, without more definite symptoms. He was unable to eat, but drank a cup of coffee and about an ounce of whiskey. Immediately afterward he drove to the railroad station, where, while rolling milk cans to his wagon, he became conscious that he was seriously ill. He rapidly became very giddy, and, fearing that he would fall, allowed himself to sink to the floor. He did not fall, and was entirely conscious, although he felt somewhat confused. He remembered perfectly well being carried into a neighboring room and remaining there for some time, awaiting the arrival of the police patrol, and he protested against being taken to the hospital. He knew that he was placed in the patrol wagon, but he soon afterward lost consciousness entirely, remembering nothing for about twelve hours thereafter.

Upon his admission to the hospital Dr. Evans, the resident physician, found him completely unconscious and exhibiting marked cyanosis. The respirations were full and deep—18 to 20 to the minute. There was no stertor, but the breathing was at first slightly irregular, a pause occupying the time of one or two respirations occurring after four or five regular breaths. The pulse was full, strong, 90 to the minute. The arteries were decidedly sclerosed, the heart sounds weak. The temperature was low, and the thermometer in the axilla failed to register. The eyes deviated toward the right. The pupils were of moderate size and responded to light. There was no evidence of paralysis in any of the extremities. No œdema was

present. Very slight convulsive movements occurred at intervals, the arms being slightly flexed for a few moments, and the chin drawn toward the chest. There was an odor of acetone to the breath so pronounced as to lead Dr. Evans to catheterize the man at once and examine his urine. This was found to be strongly acid, with a specific gravity of 1026; there was no albumin; an imperfect reduction of Fehling's solution was obtained after adding a good deal of urine; there was a marked reaction for acetone.

The man was stimulated with aromatic spirits of ammonia and strychnine. He remained in the same condition, excepting that the cyanosis deepened somewhat, while the respiration became regular. I saw him at about noon. We then emptied the bladder of the small amount of urine which it contained, and I examined it for sugar, acetone, and diacetic acid. Sugar was probably absent. There was no reduction of Fehling's unless large quantities of urine were added, and even then the reduction was but slight. Other tests were not used because of the necessity for haste. There was a marked reaction for acetone (Legal's test) and for diacetic acid. Oxybutyric acid was not looked for, as the polarimeter chanced to be out of order, and the amount of urine was too small for a crotonic acid test.

The striking facts upon seeing the man were the sickening odor of acetone, which was so strong as to be noticeable immediately upon entering the side ward in which he lay, and the peculiar character of the respirations, which were of normal rapidity, but extremely strong and deep. His condition was about the same as noted by Dr. Evans. He was intensely cyanosed, but the pulse remained strong and full, although the heart sounds were weak. Otherwise, the cardiac sounds were negative, the dulness being normal and murmurs absent. The examination of the lungs and abdomen was wholly negative. There was no evidence of any paralysis, all the extremities showing slight resistance upon movement, and, as was afterward apparent, he was capable of moving them voluntarily. The tendon reflexes were decreased in activity, but were present. He responded to energetic pricking with a pin everywhere by very slight movement and an occasional faint moan. The eyes usually deviated toward the right, though there was often left lateral deviation, and frequently there was no deviation at all. The pupils responded feebly to light.

At this time we had absolutely no history of the case except that given by the police officer (afterward shown to be incorrect) that the man had fallen from his wagon and was picked up unconscious. It was, of course, suspected that it was a case of apoplexy. In the absence, however, of all signs of apoplexy except the coma, and with the presence of conditions so characteristic of diabetic coma, it was decided that the case was one of the latter kind, and three pints of a 3 per cent. solution of sodium bicarbonate were introduced into the right median basilic vein. Williamson's blood test was made at the same time, but proved negative.

As the fluid was introduced the man opened his eyes, made a slight at-

tempt to turn to the side, moved all his limbs, and groaned feebly. His pulse became decidedly weak and irregular; the breathing also became irregular. The introduction of the fluid was temporarily stopped, and these symptoms entirely disappeared, the patient lapsing into his former condition. A similar disturbance occurred several times during the administration of the alkali, ceasing each time the flow of the fluid was checked. After the introduction of the fluid the cyanosis was distinctly less, but there were no signs of returning consciousness.

At 3 o'clock the man's condition was the same as it had been at 12. At this time the left median basilic was opened; 14 ounces of blood was removed, and, at the same time, two pints more of a 3 per cent. sodium bicarbonate solution was introduced into the vein on the right. The sugar of the removed blood was estimated by precipitating with sodium sulphate, and then determining the amount of copper reduced by the filtrate. It was found to be 0 12 per cent.—hence practically normal.

After this administration of alkali the patient showed slight signs of returning consciousness. His color distinctly improved; he made a decided effort to resist the manipulations, and groaned repeatedly. He soon, however, relapsed into practically the same condition as before. After the second administration of alkali he was given a hypodermic of one-tenth of a grain of strychnine; oxygen, also, had been repeatedly administered.

His condition remained about the same until shortly after 6 o'clock, when, after nearly eleven hours of coma, he showed the first pronounced signs of returning consciousness. Soon after this he asked where he was, but seemed confused and apparently decidedly deaf. He was still very somnolent, sleeping most of the time, but was not comatose, could be easily roused, and apparently understood questions, although it was necessary to shout in order to make him hear. He repeatedly attempted to speak, but almost unintelligibly, until about 11 o'clock, when he spoke clearly and apparently with entire intelligence.

Urine was passed at midnight; it had a specific gravity of 1020, was highly alkaline, contained no albumin, no sugar, no casts, and no diacetic acid. It gave a questionable reaction for acetone. The quantity was 15 ounces. At this time the patient showed no symptoms, with the exception of somnolence, deafness, and weakness, with some confusion of mind. There was absolutely no paralysis.

The following morning he was perfectly conscious, and his intelligence was entirely good. He showed slight deafness, but otherwise there was no indication of a previous attack. He was pallid, but not cyanosed. The volume of pulse was smaller than on the preceding day, but of fair strength. The heart sounds remained weak. He said that he felt a little confused mentally, and was weak. He gave us at this time a perfectly intelligent account of the onset of the attack and of his condition previous thereto. He realized that he was slightly deaf, and said that he had not been so previ-

ously. In the latter part of the day his mind became perfectly clear, and he said that he felt quite normal, except for slight weakness. His deafness also completely disappeared within twenty-four hours. His eye grounds, examined on the afternoon of this day, showed normal conditions. His urine was entirely normal, except for the strongly alkaline reaction; neither at this time nor subsequently could any albumin, casts, sugar, diacetic acid, or acetone be found. The subsequent course of his case was absolutely uneventful. He was discharged on December 12th, feeling perfectly well. His cardiac sounds had become stronger; his arteries, of course, showed pronounced sclerosis; otherwise, his condition was that of an entirely healthy man of his age.

I saw him twice recently. He has had no symptoms of any kind since his attack, with the exception of occasional slight præcordial oppression and slight gastric symptoms. He has been at his occupation constantly from the time of his discharge from the hospital, and says that he feels perfectly well. His urine shows absolutely no abnormality. He is still rather pallid, exhibits marked arterio sclerosis, and the heart sounds are rather weak, and are of obscure quality. There are no murmurs. The heart action is regular, and the cardiac dulness normal. Otherwise, his physical signs are normal, and he is decidedly active for a man of his age.

The conditions which, at the time and subsequently, came into consideration from the stand-point of diagnosis were: apoplexy from hemorrhage, embolism, or thrombosis; uræmia; diabetes; alcoholism; acute internal hydrocephalus, and an acid intoxication sui generis. The condition during the attack and subsequently seems to exclude entirely apoplexy from any cause. The patient had no paralytic symptoms, and—more important—it is almost impossible to believe that if he had had apoplexy from any cause which was sufficient to produce such severe and prolonged coma there would have been such complete recovery in so short a time, without any symptoms referable to the attack. Further, apoplexy would be insufficient to explain the pronounced symptoms of acid intoxication which he exhibited.

As to uræmia, the symptoms were not those of that condition, and at no time had he in the urine any evidences of disease of the kidneys.

Diabetes is clearly excluded by the previous history and, more particularly, the utter lack, while he was then under our observation or more recently, of any evidences of that disease.

It would, of course, be possible to explain the coma by a diagnosis of acute internal hydrocephalus, and the subsequent presence of deafness suggests such a condition, especially because of the findings of Burr and McCarthy in their case. I have, however, in the literature concerning acute internal hydrocephalus found no clear case in which severe evidences of the condition came on as did the attack in this man, with an almost complete absence of direct premonitory signs, produced so severe and prolonged a coma, and disappeared so rapidly and completely; and it seems improbable that such a course could occur in acute internal hydrocephalus. More important than this, however, is the fact that the patient had definite evidences of an acid intoxication. If an acute internal hydrocephalus was present it was probably secondary to the acid intoxication. It is absolutely impossible to demonstrate either that the man had an acute internal hydrocephalus or that he had not. It may be admitted that possibly such a condition was present, but such a diagnosis is both unnecessary and of itself insufficient to explain the signs of intoxication connected with the attack.

For the same reasons alcoholism is, of itself, an insufficient diagnosis. If there was alcoholism, there was with it an acid intoxication, and the general character of the symptoms and the results of treatment are enough to indicate that the acid intoxication was the most important poisoning present. Alcoholism, particularly when chronic, does tend to produce acid intoxication; indeed, the ferric chloride reaction for diacetic acid was first described by Gerhardt in cases of alcoholism. But in this case I think we are wholly unjustified in believing that alcoholism had any relation to the attack. A very careful investigation of his habits and subsequent observation of him have satisfactorily demonstrated that neither at the time of the attack nor at any other time was he addicted to excessive use of alcohol, and in the twelve hours preceding his attack he had had no more than one portion of whiskey.

The only satisfactory diagnosis that can be made in the case is that of cryptogenic acid intoxication, which was, in all probability, of gastro-intestinal origin. The man's tendency to digestive disturbance and the presence of such disturbance for some hours preceding his attack make this source of the intoxication a likely one.

It is somewhat difficult to understand how, in this case and in some others on record, a comparatively slight gastro-intestinal disturbance could give rise to a profound intoxication, for the amount of toxic substances produced in the intestine is certainly not likely to be sufficient to cause such a state directly. A clearer understanding, however, is reached through Kraus' very wise suggestion that in most instances, if not in all, we may much more properly consider that the disturbance of the gastro-intestinal tract sets in motion a general disturbance of metabolism, which results in excessive production or imperfect destruction of the acids, rather than that the acids are themselves produced in the digestive tract. We may also refer to the fact that it has been demonstrated, particularly by Magnus-Levy, that the occurrence of severe symptoms of intoxication with acids is less dependent upon the actual dosage with the acids than upon the ability of the organism to oxidize the acids to harmless substances. In diabetes, if the oxidative powers are permanently poor, intoxication will become severe much more quickly; and if, through any temporary cause, the oxidative powers are, for the time being, reduced, severe intoxication and coma are likely to occur suddenly. Analogous conditions undoubtedly exist in other diseases in which acid intoxication at times occurs, and in this man's case there was a complicating factor which would render him more liable to an intoxication of this kind—*i. e.*, poor circulation, with severe arterio-selerosis and myocardial weakness.

That, however, the signs of at least moderate acid intoxication may be largely due to actual absorption of acids or acid-producing substances from the digestive tract is fairly well shown by a recent report of Waldvogel and Hagenberg, who demonstrated that a very large increase of the acetone of the urine (it is normally present in small amounts) was observed after adding increased quantities of fats to the diet, even when actual gastro-intestinal disturbances were absent.

The case which I report is, in certain clinical features, apparently unique, so far as the literature regarding the question is concerned. I have found no other case recorded in which signs of acid intoxication of great severity appeared with such remarkable rapidity, and none other in which there was absence of prolonged gastro-intes-

tinal or other symptoms before the appearance of the signs of acid intoxication. Even in the cases in which all symptoms other than those referable to the gastro-intestinal tract were absent, there had been gastric or intestinal disturbance for at least several days before the onset of severe acid intoxication. The final course of the coma in this case was quite as remarkable. Complete recovery within a few hours, without any notable symptoms remaining behind, is without an analogue in the reported cases of this condition. It is probable that this rapidity of recovery, and perhaps the occurrence of recovery, were due to the rather heroic treatment. The man was completely saturated with alkali; he was given about 75 gm. ($2\frac{1}{2}$ oz.) of sodium bicarbonate intravenously, and his urine, which was tested with each portion passed, remained distinctly alkaline for about seventy hours after the alkaline transfusions were given. I know of no other case of acid intoxication of non-diabetic origin which was treated in this way, either successfully or unsuccessfully. There can be no doubt that direct alkaline treatment of non-diabetic acid intoxication would oftentimes be useful. At present there does not seem to be a proper recognition of the occurrence of the condition. This is undoubtedly due largely to the fact that it is not often looked for.

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ON MULTIPLE SEROSITIS—THE ASSOCIATION OF CHRONIC OBLITERATIVE PERICARDITIS WITH ASCITES:

With Particular Reference to the "Pericarditic Pseudocirrhosis of the Liver" of Pick and the "Iced Liver" (Zuckergussleber) of Curschmann.

By ALOYSIUS O. J. KELLY, A.M., M.D.

[Read March 5, 1902.]

For purposes of study, cases of chronic adhesive or obliterative pericarditis may be divided into three classes: first, cases in which the pericarditis runs its course entirely devoid of symptoms and constitutes merely an accidental though interesting finding at the necropsy; second, cases in which, sooner or later, symptoms of disturbed or impeded cardiac action manifest themselves, and in which, from the physical signs, the obliterative pericarditis is more or less susceptible of diagnosis; and, third, cases characterized clinically by marked ascites, with little or no œdema of the legs, cases in which the diagnosis of cirrhosis of the liver is usually made and which at the necropsy reveal chronic obliterative pericarditis and certain morbid changes in other tissues and organs—notably pleuritis, peritonitis, perihepatitis, nutmeg liver, red atrophy of the liver, cirrhosis of the liver, etc. It is to the third class of cases that I wish to direct attention.

In the majority of cases when chronic adhesive or obliterative pericarditis gives rise to symptoms, the symptoms that arise are those of failing cardiac compensation—palpitation of the heart, dyspnœa, cough, cyanosis, generalized œdema, effusions into the several serous cavities of the body, etc. On the contrary, in the cases that simulate cirrhosis of the liver, clinically, the first symptoms are sensations of fulness,

oppression, and weight in the upper abdomen, or there may be apparently a sudden onset with acute pain; the abdomen increases in size and may attain very large dimensions—due evidently to ascites that may necessitate repeated tappings (Rumpf's patient was tapped 301 times).

With increase in the amount of the ascites the abdominal walls become tense and painful, and the other subjective symptoms become markedly aggravated. There may be slight and transitory jaundice. Later œdema of the legs may develop. In a few cases œdema of the legs comes on early; it may remain but a short time, disappear, and not recur until shortly before the death of the patient. In rare cases it persists; but in the class of cases to which I refer it is always inconspicuous when contrasted with the excessive and constantly recurring ascites, and it scarcely attracts attention.

This symptom complex of obliterative pericarditis is of uncommon occurrence. While by no means unknown to the older writers, it attracted but little attention, and it was not until the communication of Pick, in 1896, that it became the subject of much discussion. Even at the present time it is overlooked by a number of systematic writers on diseases of the heart and of the liver, and a search through a number of recent text-books on medicine reveals little or no mention of it.

In the present state of our knowledge, it is to some extent a matter of personal opinion what cases should be included in the group of cases under discussion. From the point of view that I hope to elaborate, the earliest recorded case that I should include within this group was reported by van Deen in 1846. Subsequently cases were reported by Frerichs, Feierabend, Hambursin, Weiss, Vierordt, Tissier, Hirschler, Weinberg, Mott, Variot, Riedel, Henoch, Harris, Broadbent, and Dickinson. In 1884 Curschmann described his now well-known "zuckergussleber," or chronic hyperplastic perihepatitis—a disease characterized by a slow, insidious, and intermittent course, and persistent ascites, but without connective tissue hyperplasia in the liver. Although usually described as the "zuckergussleber" of Curschmann, this chronic hyperplastic perihepatitis was well known to a number of the earlier writers, being described by Hilton Fagge, in 1875, by Wilks and Moxon, in 1875, by Murchison, in 1868, by Bamberger in 1864, and by Rokitansky, in 1842. In 1895 a paper on the same subject, with the report of a case, was published by Rumpf. In 1896 Pick,

reporting three cases, directed attention to the symptom complex simulating that of cirrhosis of the liver, but found at the necropsy to be due to obliterative pericarditis and associated changes in other tissues.

Pick pointed out that the recurring ascites with almost entire absence of œdema of the legs, the enlarged, firm, and somewhat irregular liver, and absent or slight jaundice, strongly suggested cirrhosis of the liver, and that the obliterative pericarditis usually escaped clinical recognition—although he was enabled to make the correct diagnosis during life in the third of his reported cases. Pick suggested for these cases the designation "pericarditic pseudocirrhosis of the liver"—a designation that has since found favor with some medical writers, and he endeavored to establish an etiological relationship between the obliterative pericarditis, the enlarged liver, and the ascites. He stated that as a consequence of the pericarditis, which he looked upon as the primary disease, disturbances of circulation, with consecutive connective tissue hyperplasia in the liver, occurred, and that as a result of these ascites developed. In this class of cases he included the cases of "zuckergussleber" previously reported by Curschmann and by Rumpf. Following Pick's paper, the subject attracted considerable attention, reports of a number of cases appeared, discussions relating to the nature and the sequence of the morbid processes arose, and the interpretations of the lesions were many. Mention may be made of the papers by Heidemann, Hübler, Siegert, Werbatus, Nachod, Taylor, Ewart, Diemer, Schmaltz and Weber, Rose, Eisenmenger, Pick, Giradeau, Rosenbach, Hutinel, Türk, and others.

A disease that is identical with that under discussion has been well recognized in Italy, being known in some quarters as Concato's disease, polyorrhomenitis, or polyserositis. In 1891 Picchini published an extended report of the disease—basing his remarks upon personal observations and a critical study of the cases reported in the literature. Interesting papers were published by Cantu in 1894, and by Villani in 1895. In 1898 Hager, a German author, writing on the subject, reviewed critically the Italian literature. Since the publication of Pick's paper, papers by Schupfer, Bozzolo, Galvagni, Patella, Caporali, and others have appeared. In France the disease is sometimes known as perivisceritis.

The only reports of cases by American writers that I have been able to find are those by Osler, in 1896, by Cabot, in 1898, and by Herrick, in 1902.

The subject has not been entirely neglected by systematic writers. Thus, in 1887, Rosenbach stated that pericardial obliteration is sometimes associated with extensive fibrous perihepatitis, enlargement of the liver, and ascites, "so that one might presume that enlargement of the liver, ascites, and pericardial synechiæ stand in causal relationship the one to the other." He refers to the subject also in his book on diseases of the heart. In 1890 Strümpell wrote that in cases of pericardial obliteration, he, as well as others, had sometimes observed marked ascites (at times associated with hydrothorax) without coincident œdema of the legs. In the latest edition of his text-book on medicine, referring to the subject, he states that all the cases presenting the symptom complex under discussion are not of one nature. In 1891 Leube wrote that pericardial obliteration sometimes gives rise to swelling of the liver and consequent ascites. In 1894 Schrötter wrote that pericardial obliteration sometimes gives rise to ascites before the occurrence of general anasarca. The subject was referred to also by Osler, in the second edition of his text-book on *Practice of Medicine*, in 1895, by Quincke and Hoppe-Seyler, in 1899, and by Roberts, in 1900.

The subject may be illustrated by the report of the subjoined case. For the clinical notes, I am very much indebted to Dr. James C. Wilson, physician-in-chief, and to Dr. John B. Deaver, surgeon-in-chief, to the German Hospital.

Henry S., single, white male, aged thirty-one years, a native of Sweden, and a clerk by occupation, was admitted to the medical wards of the German Hospital, May 31, 1898, and the following history elicited: He is the only child of his parents, both of whom are living and well. He has no knowledge of his having had any of the diseases of childhood. From an early age, however, he had been subject to convulsive seizures attended with unconsciousness. It is reported that his mother was similarly affected. The spells, as they occurred in the patient, came on at irregular intervals and lasted for from several minutes to about an hour. When about sixteen years of age they increased very much in frequency. At times he had a premonition of their oncoming. During some of the lighter attacks he did not lose consciousness entirely, that is, he was more or less aware of what was transpiring about him, but he was unable to speak. When about eight years of age he had severe pains in both groins and in the upper part of both thighs. At times these were so severe as to prevent his lying

down. At about the same time he experienced paræsthetic phenomena in the rectum—he felt as though there was something creeping about in the rectum. At the age of eighteen years he acquired gonorrhœa. One year later he had a severe attack of rheumatism that lasted about three months. Since then he has had a number of minor attacks of rheumatism, but none was severe enough to disable him. In 1890 he was treated in Bellevue Hospital, New York, for what he states was malaria. (A note from the Medical Superintendent of Bellevue Hospital, under date of March 12, 1901, states that the patient was treated in the hospital for malaria, from July 13 to 18, 1890. No details of his condition at that time are available.) For a short time during 1892 the patient was confined to an asylum. He had suffered a sunstroke and had become, he states, maniacal at times. Since then he has been troubled with disordered digestion, or "stomach trouble," as he expresses it. Although he is said to have been jaundiced at times, the most obtrusive symptom has been periodic pains in the right half of the abdomen just above the right iliac fossa. These occurred at first at intervals of about a month, later at intervals of two months or more. During April, 1898, the patient was in the Jefferson Medical College Hospital for about two weeks. (Through the courtesy of Dr. H. A. Hare, I have ascertained that while in the hospital the patient was slightly jaundiced, and at times delirious, that he had several convulsions, and that although he complained of severe pain in the right upper abdominal quadrant and of tenderness over the region of the gall-bladder, careful examination under ether failed to reveal any tumor in the region of the gall-bladder or other evidences of gallstones. The liver was slightly enlarged, and the superficial veins, especially those on the right side of the abdomen and the inner side of the right thigh were distended. The urine at this time was acid in reaction, had a specific gravity of 1025, contained 3.2 per cent. of urea, and neither sugar nor albumin. Examination of the blood revealed: erythrocytes, 5,200,000; leucocytes, 24,000; and hæmoglobin, 73 per cent. A differential count of the leucocytes revealed: small lymphocytes, 4 per cent.; large lymphocytes, 5 per cent.; transitional leucocytes, 4.9 per cent.; polynuclear leucocytes, 85.1 per cent.; and eosinophiles, 1 per cent.) Shortly after leaving the Jefferson Medical College Hospital the patient's abdomen began to enlarge, the pains in the right side of the abdomen became more severe and more frequent, so that he was incapacitated for work. He was admitted to the German Hospital

complaining of severe pain and tenderness in the right upper abdominal quadrant, especially over the region of the gall-bladder, which was aggravated by deep inspiration; of pain over the pubes after micturition; at times of general pain in the right side of the abdomen; sharp cutting pains about three inches within the anus; attacks of vertigo; spots before the eyes; and of constipation of three years' duration. He smokes moderately, and formerly he consumed considerable quantities of alcohol.

On examination the only noteworthy sign was marked distention of the abdomen, due evidently to ascites. His liver dulness extended upward to the third rib. On June 2 the patient's abdomen was tapped, and 4400 c.c. of clear amber fluid was withdrawn. The fluid had a specific gravity of 1015, and contained a few erythrocytes and many leucocytes. The tapping relieved the patient very much, and afterward the liver dulness was found to be normal in area. There was marked tenderness over the region of the gall-bladder. Examination of the blood, on June 3, revealed the following: hæmoglobin, 82 per cent.; erythrocytes, 3,930,000, and leucocytes, 7300. A differential count of the leucocytes revealed the following: small lymphocytes, 11 per cent.; large lymphocytes, 9 per cent.; transitionals, 3 per cent.; polynuclear neutrophiles, 76.5 per cent., and eosinophiles, 0.5 per cent. On June 13 it was noted that the ascites was gradually reaccumulating, and the pains were becoming more frequent and more marked. On June 22 the patient was again tapped and 6700 c.c. of clear amber fluid was withdrawn. The fluid had a specific gravity of 1018, and contained a few erythrocytes and many leucocytes. On July 2 it was noted that the pain in the region of the gall-bladder had been absent since the second tapping. On this date the patient's feet were found to be slightly swollen—the first swelling of the feet since he had been in the hospital. (Upon inquiry he admitted that they had been slightly swollen on one previous occasion.) On July 9 the patient felt better than he had during the previous six months, and he was free from pain. On August 9, feeling well, he left the hospital of his own accord. His feet were not swollen at all, and he suffered no pain. His abdomen, however, contained considerable fluid, and was greater in circumference than it was when he entered the hospital. On the second day after his admission to the hospital his temperature was 102° F., and on several occasions subsequently it reached 100° F. Otherwise there was no fever. His pulse was always low: on several occasions it was 80 per

minute; usually it was between 60 and 68; and sometimes it was as low as 48 per minute. His urine was normal.

The patient was readmitted to the German Hospital, June 23, 1899, complaining of marked distention of the abdomen, pains in the region of the liver, at times of sharp shooting pain in the perineum, dyspnœa, slight pretibial œdema, diminution in the amount of urine voided daily, vertigo, and spots before his eyes. He stated that since he left the hospital his abdomen had been tapped twice. Inasmuch as the clinical diagnosis was cirrhosis of the liver, operation for the relief of the condition was proposed and acceded to by the patient. The operation was performed by Dr. John B. Deaver, July 3, 1899. In brief this consisted in irritating the peritoneum and stitching the omentum to the parietal peritoneum. The patient survived the operation four days, dying July 7, 1899.

The following are the notes of the necropsy performed by myself, July 8, 1899:

The body is that of a well-developed, fairly well-nourished male subject, with good bony development, good musculature, and moderate panniculus adiposus. There is postmortem lividity in the dependent portions of the body; the skin is slightly jaundiced; there is no œdema of the extremities. In the median line of the abdomen there is a wound, about 16 cm. in length, apparently healing by first intention. The left pleural cavity is entirely obliterated by firm adhesions—the two layers of the pleura being dull, cloudy, whitish, and thickened. The left lung is about normal in size, and mottled grayish-black in color. Its air content is normal, its consistency firm, and it shows some hypostatic congestion in the dependent portions. Its section surface is smooth, moist, glistening, dark-reddish in color, and exudes a quantity of frothy, blood-stained fluid. The lung crepitates throughout, and contains no tubercles. The bronchi are normal in size, they contain a small amount of mucus, and their mucous membrane is pale. The pulmonary vessels and the peribronchial lymph glands appear normal. The right pleural cavity is entirely obliterated by firm adhesions—the two layers of the pleura being dull, cloudy, whitish, and thickened. The right lung presents appearances similar to its fellow. The pericardium is firmly adherent to the anterior chest wall and the adjoining mediastinal tissues. The pericardial cavity is entirely obliterated, and such is the firmness of the adhesions that the

two layers of the pericardium nowhere can be distinguished. In addition the pericardium is the seat of extensive calcareous infiltration, a large section of the heart being encased in a hard calcareous sheath. This calcareous sheath implicates the pericardium of the right ventricle, about one-half of the anterior and under surface of the right auricle, the left edge of the heart, the lowermost two-thirds of the left ventricle, the apex, and the diaphragmatic surface of the heart. This calcareous sheath appears to be made up of a single calcareous plate and not of a series of disunited plates. The pericardium of the left auricle, though firmly united with the adjacent parietal pericardium, is not the seat of calcareous infiltration. The several cavities of the heart appear to be normal in size, and they contain a moderate amount of dark, reddish-brown, coagulated blood. The mitral orifice admits two fingers, the tricuspid orifice, three fingers. The mitral and tricuspid valve leaflets and the associated chordæ tendineæ are slightly thickened. The aortic and pulmonary valve leaflets are normal. Presumably all the valves are competent. The left ventricle (including the calcareous pericardium) measures 12 to 14 mm. in thickness, the right ventricle 5 to 8 mm., the left auricle 2 to 4 mm., and the right auricle 2 to 4 mm. The heart muscle is reddish-brown in color and firm in consistency. The coronary arteries and the aorta are normal. The heart and pericardium weigh 470 grammes. The omentum is normal in size and shape. The entire peritoneum is dull, lustreless, somewhat thickened, and intensely hemorrhagic. The coils of intestine are united to one another and to the other intra-abdominal organs by moderately firm, though friable, fibrinous adhesions. In some places an exudate may be stripped off in thin layers. The peritoneum contains also about 50 c.c. of serosanguinolent fluid (drainage had been provided at the time of the operation). The liver is firmly united to the under surface of the diaphragm by means of dense and firm adhesions, especially for a distance of about 6 cm. on both sides of the suspensory ligament. The capsule of the liver is thickened throughout, but especially on its upper surface, where in some places it is 4 mm. thick. In addition, on the capsule of the liver there is some fresh fibrinous exudate that may be stripped off; this is present especially on the under surface of the liver and for a short distance on the upper surface. The liver measures 22 cm. in length, 14 cm. in breadth, and 9 cm. in thickness. It weighs 1460 grammes. Its shape is normal, its consistency somewhat increased, its elasticity somewhat diminished, its surface somewhat irregular, and

its edges rounded and hard. Its section surface is dull, moist, slightly granular, opaque, and light reddish-brown in color. The liver lobules are distinct, and there appears to be a slight increase in the connective tissue of the organ. The gall-bladder is normal in size and contains fluid bile. Its mucous membrane and wall are normal. The cystic, hepatic, and common bile-ducts are patulous. The spleen measures 10 cm. in length, 8 cm. in width, and 5 cm. in thickness. It is normal in shape and weighs 210 grammes. It is firm in consistency, and its capsule is slightly thickened and covered also with some fresh fibrinous exudate. The pulp is normal, the follicles rather distinct, and the trabeculæ slightly increased. The right kidney measures 11 cm. in length, 6 cm. in width, and 3 cm. in thickness. It is normal in shape and weighs 160 grammes. Its capsule strips readily, its surface is smooth, its color dark reddish-brown, and its consistency somewhat increased. The cortex is 7 mm. thick, and dark reddish-brown in color; the pyramids are congested. The calyces, pelvis, and ureter are normal. The left kidney weighs 170 grammes, and presents appearances similar to its fellow. The adrenals are normal. The bladder contains a small quantity of clear urine; its mucous membrane and wall are normal. The stomach is normal in size and position. It contains some turbid brownish fluid. The mucous membrane is congested and somewhat swollen. The duodenum and the remainder of the intestine are normal. The brain and spinal cord were not examined.

The anatomical diagnosis was as follows: acute hemorrhagic peritonitis; chronic adhesive pericarditis, with extensive calcification; chronic bilateral adhesive pleuritis; chronic perihepatitis (pericarditic pseudocirrhosis of the liver of Pick); slight congestion of the liver, spleen, and kidneys.

Microscopical examination of the thickened pericardium revealed marked overgrowth of fibrous connective tissue with relatively few cells, and some extension of the newly-formed connective tissue into the interstices of the heart muscle. Careful examinations of sections from several regions revealed no evidences of tuberculosis. Examination of the thickened pleuræ revealed only fibroid thickening; no evidences of tuberculosis. Examination of the liver revealed chronic fibroid thickening of the capsule and some slight extension of connective tissue trabeculæ a short distance into the substance of the liver. In addition, evidences of acute inflammation were apparent, the round-cell infiltration being rather abundant. No evidence of tuberculosis could be

detected. The liver itself revealed moderate distention of the central veins of the lobules and of the adjoining capillaries, with a moderate atrophy of the intervening liver cells. The cells of the periphery of the lobules showed slight fatty infiltration. The interlobular connective tissue possibly was slightly in excess of the normal, and contained a slight amount of round-cell infiltration. The spleen revealed the usual evidences of slight congestion and slight thickening of the trabeculæ.

The occurrence of marked ascites, with little or no œdema of the extremities in cases of failing cardiac compensation, though not very common, is by no means unknown. It was mentioned by Liebermeister in 1864, by Oppolzer in 1866, and it is observed by most clinicians of experience at the present time. The difficulties attending the diagnosis in these cases, however, are sometimes very great. The question whether an enlarged liver (in advanced cases a small liver) with ascites is to be referred to a primary or a secondary liver disease, if it presents itself to the mind of the clinician at all, may be difficult of solution. Light is shed on the case by the detecting of trustworthy evidence of cardiac valvular disease—in which case, especially if the patient be an adult, one has to determine whether the liver condition and the ascites are due to the heart disease or to an associated alcoholic cirrhosis of the liver. The diagnosis is even more difficult in cases of obliterative pericarditis, which appears to give rise to disproportionate ascites more frequently than does valvular disease of the heart. In these cases the pericarditis being usually latent and more or less insusceptible of diagnosis, the ascites is generally referred to a cirrhosis of the liver, rarely to tuberculous peritonitis, etc.

The cause of disproportionate ascites in cases of obliterative pericarditis has occasioned much discussion. Thus Weiss attributed it to changes in the bloodvessels of the peritoneum, the result of chronic peritonitis. He believed that in consequence of the pericardial obliteration general venous congestion occurs; that in consequence of the inflammation of the peritoneum, the peritoneum becomes a punctum minimæ resistentiæ: that transudation of serum occurs more readily from the altered vessels of the peritoneum than from other vessels of the body; and that in consequence of the development of the ascites venous congestion in other parts of the body is relieved, and the development of œdema more or less prevented.

Mott believed that owing to the adherent pericardium interfering with the coronary circulation, the heart, instead of undergoing com-

pensatory hypertrophy, as it sometimes does in the condition under discussion, slowly undergoes degeneration, and that this is doubtless hastened by the immense loss of fluid. He stated that, moreover, the thick adherent pericardium would interfere considerably with the elasticity of the walls of the heart and greatly modify its action as a suction pump during diastole, and that the circulation that this would affect most would be the portal, because here the blood has to pass through two sets of capillaries and against gravity. This is a view that is scarcely tenable, since, were it true, we should expect predominating ascites in all cases of failing cardiac compensation.

Weinberg attributed the ascites, with little or no œdema of the legs, to angulation of the inferior vena cava or the hepatic vein due to a right-sided pleural effusion. He assumed that in consequence of the angulation of the veins congestion and other changes in the liver, with consecutive ascites, occurred; and he endeavored to support his opinions by citing the results of some experiments of Rosenbach's that appeared to show that such right-sided pleural effusion may cause angulation of the vena cava and congestion of the portal area. However, as pointed out by Pick, it is difficult to conceive of isolated compression of the hepatic vein, and compression or angulation of the inferior vena cava results in œdema of the legs rather than in ascites. Furthermore, in many of the cases there is no right-sided pleural effusion.

Rosenbach, while scarcely venturing to express a positive opinion on the subject, states that the ascites cannot be the result of simple insufficiency of the heart muscle, and he attributes considerable importance to the fibrous alterations in the liver capsule. He says, further, that the ascites must be the result of the operation of special conditions which, though associated with the heart affection, are not the direct result of diminution of the power of the heart; and that probably we have to do with an extension of the inflammatory process from the pericardium along the large veins to the serous covering of the liver, or vice versa, with the final development of connective tissue hyperplasia.

Pick, criticising adversely the opinions of Weiss, Mott, and Weinberg, points out that each of these writers in attempting to explain the occurrence of the ascites entirely overlooked that organ which, from the clinical course of the disease, one would be inclined to think most at fault—the liver. He states that in these cases the liver is described as rounded, increased in consistency, hemorrhagic, enlarged, markedly

irregular, granular, very firm, cirrhotic—in short, the appearances of the different stages of cyanotic induration, atrophic nutmeg liver, or the cardiac cirrhosis of the French. And inasmuch as other writers have observed prevailing ascites rather than œdema of the extremities in certain forms of heart disease, with similar secondary changes in the liver, he prefers to attribute the ascites in these cases of obliterative pericarditis to the alterations in the liver rather than to assume certain hypotheses. He says, further, that the question why in these cases ascites rather than generalized œdema occurs is intimately bound up with the question why in certain cases of congestion of the liver, in failing compensation of the heart in valvular disease, connective tissue proliferation occurs, whereas in other cases it does not occur; and that concerning this we know little definitely. For the time being he was content to point out the diagnostic features of the symptom complex in question. He believes that the associated peritoneal alterations are more or less accidental—that the thickening of the peritoneum results from the long-continued congestion and the persistence of the ascites, and that the thickening and the adhesions are in part due also to infection the result of repeated tappings.

Harris states: "There are two lesions, either of which may possibly occur as complications to the mediastinal and pericardial affection, and which could explain the ascites in such cases. In the first place, it is conceivable that chronic venous congestion of the liver produced by the cardiac dilatation may in some cases set up a chronic inflammation of the liver, a secondary periportal cirrhosis, which like the ordinary alcoholic cirrhosis would obstruct the portal circulation and produce ascites. We have seen that an increase of fibrous tissue in the liver is found in some of the cases of mediastino-pericarditis; but such a change does not appear to be the rule, and in the cases where it has been found it is questionable whether it has been sufficiently pronounced to produce portal obstruction and ascites therefrom. Furthermore, in one of my cases (Case II.) where the abdominal dropsy was such a prominent feature of the illness, the ascites was certainly not due to a cirrhotic liver, no marked periportal cirrhosis being found on microscopical examination. The second explanation of the occurrence of the ascites in the cases under consideration is that a chronic peritonitis ensues, and to it the ascites is due. Such chronic peritonitis in some instances may possibly be an independent affection, and one not directly connected with the mediastinal or pericardial lesion; in other cases it is

conceivable that the chronic venous congestion due to the intrathoracic affection sets up the chronic peritonitis. Such a chronic peritoneal change was found in my second case, and was clearly sufficient to account for the ascites. That it is the explanation of the ascites in all such cases, of course, we do not say. It is quite possible that other complications may, in some cases, occur which account for the development of ascites as a prominent feature of the case." After further discussion of the question, he says: "I am inclined, therefore, to think that the ascites which sometimes occurs in cases of mediastino-pericarditis, and which is unaccompanied by extreme anasarca of the lower extremities, is due, in some instances, at all events, to the onset of a peculiar form of chronic peritonitis. This chronic peritonitis may be possibly due to venous engorgement of the peritoneum consequent upon the dilatation of the heart or venous obstruction in the mediastinum, or it may occur so early in the case as to be probably independent of such venous stasis. In my second case the ascites was a prominent symptom from a very early period of the illness, and probably was independent of venous engorgement, which only appeared as a marked feature some time after the development of the ascites."

Heidemann, supporting the opinion of Weiss, states that in these cases we have to deal with a chronic inflammation of divers serous membranes; that the congestion, the result of the degeneration of the musele of the heart, leads to ascites because the vessels of the peritoneum, on account of the chronic inflammation, constitute a locus minoris resistentiæ; that the associated eirrhotie proeesses in the liver observed in these cases result from an extension of the inflammatory irritant from the liver capsule and from the chronic congestion of the organ; and that in consequence of proliferation and shrinkage of the connective tissue on and in the liver the congestion and exudation into the peritoneal cavity are increased.

Eisenmenger, a pupil of Paltauf, states that it is quite true that in consequence of obliterative perieardítis marked ascites, with little or no œdema of the legs, oceurs comparatively frequently, and that if the pericarditis is latent, the symptom complex bears a certain resemblance to eirrhosis of the liver. He states further that this symptom complex is not due, as is asserted by Pick, to connective tissue proliferation the result of disturbances of circulation in the liver, but that in different eases it is due to different causes. He emphasizes the etiological importanee of distortions, eompression, and angulations of the inferior

vena cava, produced by a concomitant exudate or pleuropericardial thickenings; concomitant peritonitis in the transverse fissure of the liver; and, because the symptom complex is observed especially in young persons, the condition of the capillaries and small vessels in healthy young persons, in consequence of which œdematous transudations occur readily. Inasmuch, then, as the disease is not an anatomical entity, he disapproves of the designation "pericarditic pseudocirrhosis of the liver," suggested by Pick.

Without detailing the opinions of other writers, it suffices to state that the opinions of Mott and Weinberg are scarcely worthy of serious consideration. In addition to the opinion of Eisenmenger, which is not supported by the report of any illustrative cases, there remain three opinions held by as many different groups of writers: the first, represented by Pick, Bozzolo, Nachod, Galvagni, Cabot, and others, attributes the ascites to changes in the liver the result of long-standing congestion; the second, represented by Weiss, Heidemann, Schupfer, Werbatus, and others, attributes the ascites primarily to the chronic peritonitis; and the third, represented by Harris, Osler, Patella, Siegert, and others, attributes the ascites to the combined action of both of these factors.

In view of these differences of opinion, it may not be unprofitable, from a study of the cases reported in the literature, to ascertain the more likely cause of the predominating ascites, and in general the nature of the disease in question. From the subjoined table I have omitted all cases in which the ascites was merely a part of generalized dropsy and effusions into the several serous cavities of the body; cases, of which Wagner's and Türk's serve as examples, in which the lesions were a disseminated tuberculosis of the organs, as well as of the serous membranes; and, for instance, a second case reported by Diemer, in which obliterative pericarditis and atrophic cirrhosis of the liver occurred, but in which there was no note of ascites. I have been obliged reluctantly to omit also a number of cases reported by Italians —Galvagni, Bozzolo, Patella, and Caporali. Their reports were unavailable in the original, and the abstracts at my disposal were not sufficiently complete to enable me to incorporate them in the table:

Reporter.	Sex and age.	Duration, years	Ascites.	Œdema.	Pericardium.	Right pleura.	Left pleura.	Peritoneum.	Liver.	Spleen.	Remarks.
Van Deen, 1846	M. 40	2	Constant.	Subsequent to ascites.	Markedly thickened and firmly adherent to the heart.	Adherent throughout	Adherent throughout	Thickened throughout; many adhesions.	Chronic perihepatitis; liver otherwise normal.	Chronic perisplenitis; spleen otherwise normal.	The peritoneum of the under surface of the diaphragm and of the upper portion of the abdomen was least affected; pericarditis believed to be the primary affection, the pleuræ and the peritoneum being affected secondarily, the peritoneum through spreading of the inflammation through the diaphragm.
Frerichs, 1861	F. 38	2	Constant.	Constant, but moderate.	Firmly adherent throughout.	Adherent throughout	Adherent throughout	Cloudy, injected, and much thickened in many places.	Marked chronic perihepatitis; cirrhosis; liver one-third smaller than normal.	Marked chronic perisplenitis; spleen enlarged.	It is believed that the liver induration was caused by a peritonitis, the symptoms of which preceded by two years symptoms referable to the liver.
Feierabend, 1866	M. 50	4	Constant.	No.	Adher'nt and markedly calcified, especially the anterior surface; the apex free.	.....	.....	.....	Marked cirrhosis.	Enlarged.	Pericarditis 23 years previously; four tappings for relief of the ascites; the clinical diagnosis was cirrhosis of the liver with secondary gastro-intestinal catarrh.
Hambursin, 1869	M. 50	4	Constant.	Only shortly before death.	Chronic adhesions to the right of the base of the heart and to diaphragm; also fluid.	Chronic adhesions.	Normal.	Chronic adhesions and thickening.	Marked chronic perihepatitis; liver small, nutmeg, and cirrhotic.	Normal.	The disease is presumed to have begun in the liver capsule and to have implicated the pericardium subsequently.
Weiss, 1876	F. 51	1½	Constant.	Constant; moderate.	Thickened and adherent throughout.	Obliterated	Obliterated	Thickened & opaque; many adhesions.	Chronic perihepatitis; liver large and firm.	Chronic perisplenitis.	Presumed to have followed rheumatism; the anatomical diagnosis was total concretion of the abdominal and thoracic organs.
Weiss, 1876	F. 14	2	Constant	Only shortly before death.	Obliterated.	Fluid.	Obliterated	Thickened & opaque; many adhesions.	Chronic perihepatitis; liver firm.	Chronic perisplenitis.	Followed typhoid fever; many tappings for relief of the ascites.
Vierordt, 1884	F. 20	6	Constant.	Slight late in the course of the disease.	Obliterated.	Chronic adhesions.	Normal.	Thickened & opaque; many adhesions.	Chronic perihepatitis; cirrhosis.	Chronic perisplenitis; spleen enlarged.	Presumed to have begun in the liver capsule; standstill for 1 year; 31 tappings (460 litres of fluid) for relief of the ascites.

Vierordt, 1884	F. 35	6	Constant.	Slight and transient.	Obliterated; marked calcification.	Obliterat'd; thickened.	Obliterat'd; thickened.	Thickened & opaque; many adhesions.	Marked chronic perihepatitis (zuckergussleber); liver nutmeg.	Marked chronic perisplenitis (zuckergussmilz); spleen enlarged.	Presumed to have started in the pericardium; standstill for several years; several tappings for relief of the ascites; it is suggested that the peritonitis and the chronic inflammatory changes in the pericardium stand in some relationship to each other.
Curschmann, 1884	F. 54	6½	Constant.	No.	Obliterated; thickened.	Obliterat'd; thickened.	Acute serofibrinous inflammation.	Thickening, induration, opacity, and adhesions of the peritoneum of the upper half of the abdomen.	Diffuse chronic hyperplastic perihepatitis; compression and reduction in size(⅓) of the otherwise unaltered liver.	Marked chronic perisplenitis; spleen double the normal size.	Many tappings for relief of the ascites; standstill for a year and a half; recent tuberculous peritonitis at the necropsy.
Tissier, 1885	F. 51	10	Constant.	Yes.	Obliterated; calcification at lett edge anteriorly & posteriorly; apex free.	Fluid.	Fluid.	Thickening, opacity and adhesions.	Marked chronic perihepatitis (zuckergussleber); liver enenlarged and nutmeg.	Chronic perisplenitis.	Several punetures for relief of the ascites.
Hirschler, 1886	F. 48	...	Constant.	Slight.	Obliterated.	Fluid.					
Weinberg, 1887	M. 19	⅓	Constant, though preceded by symptoms of acute pleuritis	Subsequent to the ascites.	Thickened and obliterated.	Fluid.	Fluid.	Chronic peritonitis.	Chronic perihepatitis; liver nutmeg.	Enlarged.	Two tappings for relief of the ascites; process tuberculous, the result of primary infection of the pericardium by a tuberculous bronchial lymph gland.
Weinberg, 1887	F. 18	⅔	Constant.	Late in the course of the disease.	Thickened and obliterated.	Obliterated	Obliterated	Thickening, opacity and adhesions.	Chronic perihepatitis (not so marked on diaphragmatic surface as elsewhere); liver congested; weight 2050 grammes.	Normal.	Fifteen tappings for relief of the ascites; process tuberculous, the result of primary infection of the pericardium by tuberculous bronchial lymph gland.
Mott, 1887	M. 17	2½	Constant.	Only shortly before death.	Thickened and obliterated.	Thickened and obliterated.	Thickened and obliterated.	Inflammatory lymph	Nutmeg; weight 54 ounces.	Normal.	Several tappings for relief of the ascites; process began as a pleuropericarditis.
Mott, 1887	M. 23	1½	Constant.	Subsequent to and less than the ascites.	Thickened and obliterated.	Recent serofibrinous exudate.	Thickened and obliterated.	....	Enlarged; weight 5 pounds.	Congested; weight 18 oz.	Process began as a pleuropericarditis.

Reporter.	Sex and age.	Duration, years.	Ascites.	Œdema.	Pericardium.	Right pleura.	Left pleura.	Peritoneum.	Liver.	Spleen.	Remarks.
Variot, 1888	M. 51	...	Constant.	.....	Obliterated; marked calcification of anterior surface of right ventricle, left auricle, right edge, and posterior surface.	Chronic adhesions and fluid.	Chronic adhesions	Chronic adhesions.	Marked chronic perihepatitis (zuckergussleber); liver enlarged.	Somewhat enlarged.	Clinical diagnosis: mitral insufficiency and right-sided pleural effusion.
Riedel, 1892	M. 19	15	Constant.	Only shortly before death	Thickened and obliterated.	Chronic adhesions, thickening and fluid.	Chronic adhesions, thickening, and fluid.	Entire peritoneum markedly thickened and adherent.	Marked chronic perihepatitis (zuckergussleber) with extension of connective tissue into the liver substance.	Chronic perisplenitis; spleen enlarged.	Heart, lungs, liver, and spleen—zuckerguss; several tappings for relief of the ascites. Process presumed to have begun in the different serous membranes at the same time, although it is admitted that the disease may have begun in the pericardium as a complication of pertussis, and subsequently have implicated the other serous membranes by contiguity of structure. Standstill for eight years.
Cantu, 1894	F. 41	...	Constant.	.....	Thickened and obliterated.	Fluid.	Fluid.	.....	Nutmeg.	Congested.	
Rumpf, 1895	F. 49	16	Constant.	Of left leg.	Thickened and obliterated.	Chronic adhesions and fluid.	Chronic adhesions and thickening.	Thickening, opacity and adhesions.	Diffuse chronic hyperplastic perinephritis (zuckergussleber); compression of the otherwise unaltered liver.	Chronic perisplenitis; spleen moderately enlarged.	301 tappings for relief of the ascites; process presumed to have begun in the pericardium; acute pericarditis at the age of 33 years.
Henoch, 1895	M. 5	14 days (?)	Constant.	Constant.	Thickened and obliterated.	Thickened and adherent.	Thickened and adherent.	.....	Chronic perihepatitis; liver enlarged and cirrhotic.	Enlarged.	Presumed to be syphilitic.
Harris, 1895	M. 8	3½	Constant.	Slight.	Thickened and obliterated.	Thickened and obliterated.	Thickened and obliterated.	Thickening, opacity and adhesions.	Marked chronic perihepatitis; liver nutmeg; little or no cirrhosis.	Marked chronic perisplenitis; spleen congested.	Many tappings for relief of the ascites; old tuberculous focus in the apex of the right lung; tuberculous arthritis of the right elbow.
Broadbent, 1895	F. 16	½	Constant.	Present, but much less than the ascites	Thickened and obliterated.	.. ..	... .	Recent miliary tuberculosis.	Enlarged and nutmeg.	.....	Tuberculous focus in the apex of the left lung; striking feature of the case "the constant accumulation of fluid in the peritoneal cavity."

Pick, 1896	M. 47	4	Constant.	Slight.	Thickened and obliterated.	Fluid.	Chronic adhesions.	General fibrous peritonitis.	Chronic perihepatitis: liver enlarged and nutmeg	Chronic perisplenitis: spleen congested.	Many tappings for relief of the ascites.
Pick, 1896	M. 26	8	Constant.	Late in the course of the disease.	Thickened and obliterated; extensive calcification.	Fluid.	Fluid.	....	Enlarged and cirrhotic.	Enlarged five times the normal size.	Many tappings for relief of the ascites.
Pick, 1896	M. 24	2	Constant.	Subsequent to the ascites.	Obliterated; extensive calcification.	Chronic adhesions.	Chronic adhesions.	Thickening, opacity and adhesions.	Perihepatitis and cirrhosis.	Perisplenitis.	Process tuberculous; correct diagnosis during life.
Osler, 1896	F. 14	3½	Constant.	General at first; disappeared; reappeared: but always slight.	Thickened and partly obliterated.	Chronic adhesions.	.....	Thickening, opacity and adhesions.	Marked chronic perihepatitis and cirrhosis.	Perisplenitis: spleen enlarged and congested.	Correct diagnosis during life; extreme cyanosis of the hands and feet, and subcutaneous nodules about the knuckles, wrists, and elbows; 121 tappings for relief of the ascites
Dickinson, 1896	F. 17	5	Constant.	Much less than the ascites.	Thickened and obliterated.	Chronic adhesions.	Obliterated	.....	Enlarged (64 oz.) and nutmeg; capsule thickened.	.....	26 tappings for relief of the ascites.
Heidemann, 1897	F. 15	1	Constant.	Subsequent to the ascites.	Obliterated.	Chronic adhesions and fluid.	Serofibrinous exudate.	Fibrous peritonitis, especially of Douglas' cul-de sac.	Small nutmeg and cirrhotic.	Somewhat enlarged.	Pericarditis one year previously; 23 tappings for relief of the ascites.
Schupfer, 1897	M. 44	4¼	Constant.	Slight at beginning; disappear'd and recurred shortly before death.	Obliterated.	Thickened and obliterated.	Thickened and obliterated.	Chronic fibrous hyperplastic peritonitis	Marked chronic perihepatitis with extension of the connective tissue into the liver substance.	Perisplenitis.	Presumed to have begun at the same time in the different serous membranes; standstill for one year.
Cabot, 1898	M. 18	6	Constant.	Slight at intervals.	Obliterated.	Chronic adhesions and fluid.	Chronic adhesions and fluid.	.....	Enlarged and nutmeg.	.....	Several tappings for relief of the ascites.
Siegert, 1898	M. 19	9	Constant.	General at the beginning; disappeared, and recurred for short periods, & again before death.	Thickened and obliterated.	Chronic adhesions.	Chronic adhesions.	Thickening, opacity and adhesions.	Chronic perihepatitis with extension of connective tissue into the liver substance; liver congested.	Perisplenitis; spleen slightly enlarged.	Presumed to have begun in the pericardium; standstill for two and a half years, more than 100 tappings for relief of ascites.
Werbatus, 1898	M. 42	6	Constant.	Subsequent to the ascites.	Thickened and obliterated.	Thickened and obliterated.	Thickened and obliterated.	Thickening, opacity and adhesions	Chronic perihepatitis: atrophic nutmeg liver and cirrhosis.	Chronic perisplenitis and congestion	

Reporter,	Sex and age.	Duration, years.	Ascites.	Œdema.	Pericardium.	Right pleura.	Left pleura.	Peritoneum.	Liver.	Spleen.	Remarks.
Nachod, 1898	M. 6	1	Constant.	Slight at beginning; disappear'd and reappeared shortly before death.	Thickened and obliterated.	Extensive adhesions.	Extensive adhesions.	Chronic adhesions.	Liver firmer than normal; many caseous nodules in the capsule.	Enlarged; capsule thickened and contained many caseous nodules.	Nine months prior to death, with the idea that the ascites was due to tuberculous peritonitis, coeliotomy was performed, but the peritoneum was found entirely normal; the pericarditis evidently was primary; some bronchial glands were tuberculous.
Taylor, 1898	F. 42	1½	Constant.	Subsequent to the ascites.	Thickened and obliterated.	Thickened and obliterated.	Thickened and obliterated.	Univers'lly thick and opaque.	Perihepatitis and compression of the liver.	Perisplenitis; spleen hard and small.	
Ewart, 1899	F 19	4	Constant.	Slight.	Obliterated and calcified.	.....	.....	Adhesions and thickening.	Enlarged and congested.	Perisplenitis.	Operated upon for the cure of a supposed cirrhosis of the liver; previously to the operation fifty-two tappings for the relief of the ascites.
Diemer, 1899	M 38	1½	Constant.	Present at first; disappeared, and reappeared.	Obliterated; extensive calcification, wide calcareous circlet about both ventricles; apex free.	Thickening and chronic adhesions.	Normal.	Diffuse thickening and adhesions.	Chronic fibrous perihepatitis (zuckergussleber); diffuse syphilitic cirrhosis.	Chronic perisplenitis (zuckergussmilz); chronic congestion.	Many tappings for relief of the ascites.
Schmaltz and Weber, 1899	F. 42	5	Constant.	Slight subsequent to the ascites.	Obliterated by recent adhesions.	Slight adhesions.	Adhesions.	Chronic adhesions.	Marked chronic perihepatitis (zuckergussleber); no connective tissue increase or marked congestion.	Marked chronic perisplenitis (zuckergussmilz); congestion.	Many tappings for relief of the ascites; standstill for two years.
Herrick, 1902	M. 20	1	Constant.	Present at first; disappeared and recurred.	Obliterated; extensive calcification of left half anteriorly & posteriorly, and of diaphragmatic surface.	Obliterated and thickened; small tuberculous sac.	Obliterated and thickened.	Smooth except for the perihepatitis and perisplenitis.	Chronic perihepatitis; liver firm; weight 2255 grammes; microscopic examination showed "cardiac cirrhosis."	Perisplenitis; spleen greatly enlarged.	Process tuberculous; several tappings for relief of the ascites and the pleural effusion; standstill for one year.
Kelly, 1902	M. 31	7	Constant	Slight and transitory.	Obliterated; extensive calcification of both ventricles.	Thickened and obliterated.	Thickened and obliterated,	Recent hemorrhagic peritonitis.	Chronic perihepatitis; congestion.	Congestion.	Several tappings for relief of the ascites.

Of the 39 cases in the table, 21 occurred in males, and 18 in females. The ages of the patients were as follows: 3 were under ten years of age; 13 were between eleven and twenty years; 3 were between twenty-one and thirty years; 5 were between thirty-one and forty years; 11 were between forty-one and fifty years; and 4 were between fifty-one and fifty-four years. This summary well illustrates a fact commented upon by a number of writers, namely, the prevalence of the disease among young subjects. Presumably, it indicates also that should the patient survive the twentieth year he or she is likely to live until the fourth decade of life. In 3 of the cases the duration of the disease was not ascertainable. In 26 cases the duration was two years or more; in 19 cases it was four years or more; in 1 case it was ten years; in 1 case it was fifteen years; and in 1 case it was sixteen years. In 1 case (Henoch's) the duration is put questionably at fourteen days. The striking clinical feature of all of the cases was the constant and predominating ascites, an ascites that necessitated many tappings and continuously recurred—whence the diagnosis in many cases of cirrhosis of the liver, in other cases of peritoneal tuberculosis. In most of the cases œdema of the legs was absent until shortly before death. In a few cases œdema was slight throughout the course of the disease, and in several of these it increased moderately or considerably shortly before death. In other cases it was present early in the course of the disease, but it soon disappeared, although the ascites persisted, and it did not recur until shortly before death; or it reappeared and disappeared irregularly throughout the course of the disease.

With regard to the anatomical lesions—in one case (Schmaltz and Weber's) the pericardium was obliterated by recent adhesions. In the remaining 38 cases the pericardium was thickened and obliterated by chronic adhesions—in almost all of the cases entirely obliterated, in one or two cases only partly obliterated. In 10 of the cases there was, in addition, more or less extensive calcification of the pericardium —the case herewith reported being the most marked example of this condition that I have encountered.

There is no statement with regard to the condition of the right pleura in 3 cases. In 1 case the right pleura contained recent serofibrinous exudate, in 6 cases it contained fluid, in 12 cases there were more or less extensive chronic adhesions, and in the remaining 17 cases the pleura was entirely obliterated and generally thickened. There is no statement with regard to the condition of the left pleura in 5 cases. In 3 cases the left pleura was normal, in 2 cases it contained recent

serofibrinous exudate, in 4 cases it contained fluid, in 10 cases there were more or less extensive chronic adhesions, and in the remaining 15 cases the pleura was entirely obliterated and generally thickened. In most of the cases in which there were chronic adhesions fluid also was present, and in most of the cases in which there were thickening and obliteration of the pleura and pericardial sacs there were also external adhesions binding the pericardium to the chest wall and external surface of the pleura and the adjacent tissues of the mediastinum. The summary well illustrates the more marked involvement of the right pleura as contrasted with the left pleura—a subject that has been much commented upon recently. There is no statement with regard to the condition of the general peritoneum in 8 cases. In 1 case there was recent hemorrhagic peritonitis, in 1 case recent miliary tuberculosis, and in 1 case inflammatory lymph, and in the remaining 28 cases there were more or less extensive chronic adhesions.

There is no statement with regard to the condition of the liver in 1 case. In 28 cases chronic perihepatitis was noted, and in 31 cases there was either chronic perihepatitis or chronic peritonitis or both. The liver itself was reported to be nutmeg in appearance in 14 cases, cirrhotic in 8 cases, large and firm in 5 cases, normal aside from compression in 4 cases, nutmeg and cirrhotic in 4 cases, and in 3 cases there appeared to be only extension of connective tissue from the thickened capsule into the substance of the organ. Perisplenitis was noted in 23 cases. There was no statement with regard to the condition of the spleen itself in 12 cases. In 23 cases it was congested, in 1 case it was small and hard, and in 3 cases it was normal.

From this tabulation and summary two facts stand out prominently: 1. That although all the cases presented ascites as the striking clinical feature and revealed obliterative pericarditis at the necropsy, yet that organ that we might presume to be most at fault—the liver—presented a variety of lesions in the different cases; and 2, that in all the cases more than one serous membrane, in some of the cases all the serous membranes were diseased. The feature possessed by the cases in common, therefore, is wide-spread disease of the serous membranes, and the most common lesion is chronic hyperplastic serositis.

In some cases there is a clear history of the repeated occurrence of inflammation of one or more serous membranes; in other cases the disease was latent and entirely unsuspected during life. In some cases the history points definitely to a certain serous membrane as the point of departure of the disease, to the membrane whence the inflammatory

process spread to the other membranes. In this connection, however, we should bear in mind that the serous membrane disease that attracted attention in some of these cases began acutely, and that such disease of a serous membrane may just as well be the consequence as the cause of a latent inflammation of some other serous membrane. Thus it is that in some of the cases with multiple involvement of the serous membranes, different writers interpret the necropsy findings differently. Some attribute the symptom complex to a primary pericarditis with consecutive pleuritis and peritonitis; others hold the opposite view, and look upon the peritonitis as the primary event, and attribute the pleuritis and pericarditis to extension of the inflammation through the diaphragm from a perihepatitis; others hold that the perihepatitis is the primary disease and that from this by continuity and contiguity of structure the peritonitis and the pericarditis arise; and, finally, still others hold that all of the serous membranes become infected with the same noxious agent at the same time.

From this point of view Picchini distinguishes four groups of cases of multiple serositis or polyserositis: 1. Cases in which by means of careful inquiry the point of origin of the disease, that is, the serous membrane first affected, as well as the order of the involvement of the other serous membranes, may be determined. 2. Cases in which on inquiry the point of origin of the disease may be determined, but in which the first examination of the patient reveals that several serous membranes are already affected, although they manifest no clinical symptoms. 3. Cases in which the history reveals that from the beginning several serous membranes have been affected. 4. Cases in which from the history it cannot be determined whether the disease began with inflammation of one or more serous membranes. Of the 50 cases observed by Picchini, 37 belonged to the first group; 11 to the second; 1 to the third, and 1 to the fourth group. Of 110 collected by Picchini (50 observed by himself and 60 collected from the literature) the peritoneum was involved in all, although this was recognized clinically in only 13 of the cases. This peritonitis was not only the most frequent, but also the most important lesion; it dominated the situation. Pleuritis was present in 109 cases, in 73 of which it was bilateral. The pericardium was least frequently involved—only in 9 of 50 cases. This fact is deemed evidence of great resistance on the part of the pericardium.

De Renzi states that in multiple serositis the peritoneum is usually involved first; then the right pleura, and then the pericardium. If,

however, the right pleura should be involved first, the disease then extends to the peritoneum, thence to the left pleura and the pericardium. In some cases, however, this mode of progression of the disease is not preserved, as sometimes a pericarditis that usually is not to be diagnosticated develops first. De Renzi states further that the disease is characterized by the fact that it remains localized to the serous membranes; that it does not implicate the intra-abdominal and intrathoracic organs; that it pursues a remarkably slow and insidious course; that it gives rise to the exudation of large quantities of serofibrinous fluid; and that the fluid portion of the exudate tends to become absorbed, in consequence of which fibrous adhesions with complete obliteration of the serous cavities result.

Presuming, then, that the inflammation may begin in any serous membrane, it is evident that the clinical manifestations may vary, depending upon the serous membrane first affected. This is commented upon by a number of writers, and it is discussed at length by Siegert, who points out that although the chronic perihepatitis and the resultant ascites dominate the clinical picture, the clinical picture nevertheless assumes quite different aspects depending upon whether the disease begins in one or more serous membranes. Thus, if the liver capsule is first affected ascites occurs as an inflammatory exudate. If after the lapse of some time the perihepatitis leads to compression of the liver and the portal radicles, another factor contributing to congestion and ascites is added. Thus it is that ascites is the prominent symptom in those cases of multiple serositis in which the disease begins in the peritoneum. Later in the course of the disease the marked increase in the intra-abdominal pressure occasioned by the large amount of the ascites, as well as the spread of the inflammatory process to the pleura and the pericardium, may lead to congestion in the area of collection of the inferior vena cava, so that to the ascites œdema of the legs is added.

That multiple serositis may begin in one or the other pleura must be conceded, and that such is really the case is rendered likely by the history of early and apparently primary pleuritis in several of the cases tabulated. Especial interest, however, attaches to primary involvement of the pericardium. In the reports of some of the cases tabulated there appears a note that acute pericarditis occurred some years prior to the development of the symptoms that interest us at present, and in other of the cases the nature and the extent of pericardial lesions warrant the assumption that these were the primary lesions—for instance, the cases reported by Feierabend, Vierordt, Weinberg, Mott, Riedel (?),

Rumpf, Pick, Osler, Heidemann, Siegert, Nachod, Ewart, and my own case. When the pericardium is primarily affected certain features in the clinical course of the disease may occur that possess especial interest and diagnostic importance. Whereas in those cases in which the peritonitis or perihepatitis is the primary event, ascites occurs early and is succeeded by œdema only late in the course of the disease, in the cases beginning with pericarditis œdema of the legs may occur early—the consequence of early and transitory insufficiency of the myocardium. In cases in which this occurs the œdema usually soon disappears and is succeeded by ascites, which assumes and maintains the ascendency—for instance, cases reported by Vierordt, Broadbent, Rumpf, Osler, Dickinson, Schupfer, Siegert, Nachod, and Diemer. However, as pointed out by Siegert, the absence of œdema of the legs in the presence of ascites early in the course of the disease is no evidence of primary implication of the peritoneum rather than of the pericardium, since it is well known that chronic obliterative pericarditis frequently runs a course entirely devoid of symptoms.

The cause of this obliterative pericarditis, as well as the cause of the multiple serositis in general, has occasioned considerable discussion. Certain of the infective diseases, such as typhoid fever, pertussis, malaria, syphilis, and rheumatism, are given as etiological factors in a number of the cases tabulated. In a number of the cases the lesions are of extremely obscure or unknown etiology, whereas, in other cases the provoking agent was certainly the tubercle bacillus. The fact that possesses considerable interest in this connection is that during recent years medical writers have become more and more inclined to look upon many cases of chronic obliterative pericarditis (as well as disease of other serous membranes) as tuberculous in nature, and this even in the absence of clear evidence of tuberculosis. This has been insisted upon for a number of years by the German and the Italian writers, and it is emphasized by Riesman and by Wells in their recent communications. According to a number of writers the disease is always tuberculous in nature; other writers, however, are disposed to admit the occasional operation of other etiological factors, inasmuch as it has not been possible to demonstrate the tuberculous nature of all cases by either macroscopical, microscopical, or bacteriological examinations. The important fact to bear in mind is that many cases apparently non-tuberculous are in reality due to the tubercle bacillus, and that in some cases characteristic tuberculous lesions may be detected by microscopical examination of the tissues, and that the tubercle bacillus may be recovered

from some of the lesions by appropriate bacteriological and inoculation procedures. Presumably, also, the patient would react to tuberculin injections. On the other hand, that a number of cases are not tuberculous must be conceded. In my own case careful microscopical examination of the tissues failed to disclose any tuberculous lesions. I would suggest that in my own case, as well as in other cases, antecedent rheumatism possesses considerable etiological importance. In some cases chronic nephritis may be the etiological factor; whereas in other cases the disease seems to develop from cholelithiasis with cholecystitis and pericholecystitis (localized peritonitis).

An important and interesting fact especially insisted upon by the Italian writers is that not every case of general tuberculosis that implicates the serous membranes and gives rise to chronic fibrous lesions belongs to the group of cases under discussion. Picchini states that the cases under discussion differ from the ordinary cases of serous membrane tuberculosis in that in their etiology heredity appears to play no rôle; that the disease does not appear to affect especially persons of phthisical or tuberculous habitus; that the inflammations of the serous membranes set in insidiously, much less acutely than do the ordinary cases of tuberculous inflammation; that they may remain latent for a long time; and that the lesions remain localized to the serous investment of the organs and are unassociated with tuberculous lesions of the lungs, as is so common in the ordinary cases. A study of the cases reported in the literature bears out the reasonableness of this view. A marked susceptibility of the serous membranes and a certain immunity of the organs to the cause of the disease—presumably the tubercle bacillus in many of the cases—appear to be striking features of the cases. Nevertheless, there seem to be border-line cases and cases representing varying degrees of infection with the tubercle bacillus: 1. Cases in which the lesions are confined strictly to the serous membranes. 2. Cases in which the lesions involve, especially the serous membranes, but in which one or several tuberculous foci may be found in the body—for instance, the cases reported by Weinberg, Harris, Broadbent, Pick, and Nachod. 3. Cases in which the serous membrane disease represents but a part of a general tuberculous infection (not considered in this communication). That this is probably true is borne out by the fact that in one or two of the cases the fatal termination was brought about by an acute disseminated miliary tuberculosis. Cantu accounts for the peculiarities of the disease as contrasted with the ordinary cases of tuberculosis of the serous membranes by assuming that it is due to a special form of the tubercle bacillus. On account of

the length and arrangement of the tubercle bacilli in the newly formed connective tissue in his case, he assumed that the bacillus operative was allied to that form peculiar to birds.

Some discussion has been occasioned by certain writers—Pick, Schupfer, Werbatus, Heidemann, and others—including the group of cases under consideration, the cases of "zuckergussleber," reported by Curschmann, Rumpf, and Hübler. Reference to the table will show that the cases of Curschmann and of Rumpf are in reality cases of multiple serositis, that in them the lesions of the serous membranes were wide-spread. In Hübler's case, as well as in a number of cases reported by Hale White, the lesions were confined to the peritoneum. Inasmuch, however, as the lesions in these cases are similar to the more wide-spread lesions in the other cases, it is warrantable to group all of them in the same category as cases of more or less extensive serositis. The cases differ among themselves in the extent and intensity of the serous membrane involvement, but in all the cases the lesions are alike. We have to explain, however, the greater intensity of the lesions about the liver in the cases in which the peritoneum is the only serous membrane involved, as well as in other cases in which the pleuræ and the pericardium also are involved.

The intensity of the lesions about the liver finds its explanation in certain facts known regarding the anatomy, physiology, and pathology of the peritoneum and its circulation. The facts that interest us at present have been worked out by a number of investigators, and they have been confirmed and summarized by Clark about as follows: Fluids and solids may pass through the endothelial layer of the peritoneum, the fluids in many places, the solid particles only through the central tendon in the diaphragm. Minute particles are carried in an incredibly short time from the peritoneal cavity through the diaphragm into the mediastinal lymph vessels and glands, and thence into the blood circulation, by which they are distributed to the abdominal organs, to appear in the collecting lymph glands of these organs. The leucocytes are largely the bearers of foreign bodies from the peritoneal cavity through the diaphragm into the mediastinal lymph vessels and thence into the blood circulation. There is normally a force in the peritoneal cavity which carries the fluids and foreign particles toward the diaphragm, regardless of the posture of the patient, though gravity can greatly favor or retard the current. It is pointed out also by Clark that under normal circumstances the peritoneum can dispose of pyogenic organisms in varying number, depending upon the virulence of the organism, without producing peritonitis, and that the pathways whereby

these are eliminated are as just mentioned, that is, toward the central tendon of the diaphragm and thence to the mediastinal lymph glands.

Now, what I believe is that what is true as regards experimental work and acute infections is true also as regards chronic infections; that is, the attempt on the part of the peritoneum to remove certain noxious agents—for instance, the tubercle bacillus, the infective agent of rheumatism and other diseases, probably certain toxic substances—may result in partial or complete success. In the latter instance the peritoneum may be completely rid of the infective agent, which, being carried to the mediastinal lymph vessels and lymph glands may infect the pericardium or the pleura, giving rise to a primary pleuritis or pericarditis. Subsequently the peritoneum may become infected. In other cases the attempt on the part of the peritoneum to remove the infective agent being only partially successful, the region about the liver and the under surface of the diaphragm succumbs, and a primary perihepatitis occurs. Subsequently the infective agent may travel through the diaphragm and infect the pericardium, or the pleura, or both. In these cases, on account of the peculiar lymphatic supply of the surface of the liver and the under surface of the diaphragm, the infective agent being as it were concentrated to the region about the liver, especially to the neighborhood of the suspensory ligament toward which many of the lymphatics converge, gives rise to the excessive and often hyperplastic lesions sometimes observed. The peculiarities of course and of distribution of the lymphatics of this region are also accountable for the much greater involvement of the upper surface of the liver (as contrasted with the lower surface) that is present in most of the cases. In this class of cases the primary infection of the peritoneum may be hematogenic in origin; or it may be of more local source, such as the intestinal tract or the urinary organs; or, in the case of women, it may result from some genital infection, as appears to have been the fact in Caporali's case. In a number of cases, on the other hand, a primary pericarditis occurs independently of peritoneal infection. Many of these cases are tuberculous in nature—the result generally of extension of disease from tuberculous mediastinal or peribronchial lymph glands, a subject recently discussed at length by Riesman. Following such initial infection of the pericardium the other serous membranes may become implicated in the diseased process. Thus either an ascending or a descending infection of the several serous membranes may occur; and there is no reason for not believing that in some cases all the serous membranes may become infected at the same time by the same infective agent.

The condition of the liver in these cases now demands consideration. In assigning to the liver a rôle in the production of the ascites we have to bear in mind that in 31 of the cases tabulated chronic peritonitis or chronic perihepatitis or both were present. (There is no note with regard to the condition of the liver in 1 case.) Thus in 31 of the cases the ascites may be accounted for without reference to the condition of the liver substance. In the 7 cases in which there is no note of perihepatitis or peritonitis the liver is described as nutmeg or cirrhotic, or both. In the case of cirrhosis (Feierabend) the ascites may be attributed to the cirrhosis, which may have been an independent affection or the consequence of the long-standing congestion. With regard to the remaining 6 cases—1 of Mott's showed recent inflammatory lymph in the peritoneum, Broadbent's showed recent miliary tuberculosis, whereas the reports of the other 4 cases (Mott, Cantu, Pick, and Cabot) contain no statement whatever with regard to the condition of the peritoneum. In the absence of statements to the contrary, assuming that the peritoneum was normal in these cases, the cases in which one has to invoke the activity of the liver alone to explain the occurrence of the ascites are still very few. In the majority of cases the ascites is satisfactorily explained by the perihepatitis and the peritonitis, and this fact has to be borne in mind by those that would assign predominance to the liver in the causation of the ascites.

Again, the condition of the liver in the majority of these cases is scarcely that which we usually associate with the production of ascites. In the cases in which the liver was normal aside from compression, as well as in the cases in which there appeared to be only extension of connective tissue from the thickened capsule into the substance of the organ, predominance in the production of the ascites cannot be ascribed to the liver. Even with regard to the cases in which, in addition to the perihepatitis, cirrhosis of the liver was present, we have to bear in mind that the ascites, in most of the cases, was present at a time when clinically the liver was normal in size or enlarged and presumably not cirrhotic. With regard to the cases in which the liver was large and firm or nutmeg in appearance we have to bear in mind that most of the livers that were subjected to careful microscopical study revealed, as a rule, only varying degrees of chronic congestion and its consequences, and that in many cases the entire absence of periportal connective tissue proliferation has been emphasized. In some of the other cases the connective tissue proliferation although present has been inconspicuous—certainly in most of the cases insufficient alone to

account for the ascites, a subject discussed in detail by Eisenmenger. Contrary to the opinion held by Piek and others, therefore, I believe that in the majority of cases primary importance in the production of the ascites cannot be assigned to the liver. However, that the condition of the liver may be a contributing factor in the causation of the ascites, and in the increase of an ascites produced by the serositis (perihepatitis or peritonitis), as for instance, in cases of associated cirrhosis, etc., must be conceded; that in a few cases the ascites may be brought about in the manner maintained by Piek, that is, as a direct result of the congestion of the liver, may also be conceded. These, which are rare cases, may be likened to the unusual cases of valvular disease of the heart in which disproportionate ascites occurs. Still, it is important to bear in mind that these two classes of cases differ in this respect—that an isolated ascites, such as was present for a long time in many of the cases herewith tabulated, rarely if ever occurs in valvular disease of the heart. In both disproportionate ascites is not uncommon; in valvular disease of the heart, however, the disproportionate ascites is accompanied by more or less œdema of the extremities, as well as of the trunk—an association that is not uncommon in certain cases of obliterative pericarditis. Under such circumstances the differential diagnosis between these two conditions is a matter of extreme difficulty, if not of impossibility—a subject recently discussed in detail by Türk. At present, however, I am concerned not so much with this class of cases as with that class in which for a long time isolated ascites is the striking clinical feature. I am inclined to concur with Rosenbach, who states that in these cases the ascites must be the result of the operation of special conditions which although associated with the heart (or pericardial) disease are not the direct result of diminution of the power of the heart and of consequent congestion. While it is probable that all the cases that present the complex of obliterative pericarditis and ascites may not be of the same nature, I should like to emphasize the importance of the perihepatitis and the peritonitis in the causation of the ascites.

In this connection I cannot forbear to refer to some extremely interesting observations made some years ago by Hale White. This writer, basing his remarks upon 34 cases of cirrhosis of the liver, stated that he was not able to find the report of a single case of uncomplicated cirrhosis of the liver in which the patient long survived paracentesis of the abdomen, that not one patient lived long enough for paracentesis to become necessary a second time, and that many patients died before

it became necessary at all. Referring then to a group of 10 cases that had been regarded as cases of cirrhosis of the liver but in which paracentesis had been performed more than once, he concluded: That the supervention of ascites in uncomplicated cirrhosis of the liver means that the end is near; that if a patient with ascites and cirrhosis of the liver lives long enough to require a second paracentesis, it is in the highest degree probable that either the diagnosis is incorrect or that some cause other than cirrhosis exists to explain the ascites; and that such cases nearly always turn out to be examples of chronic peritonitis, with perihepatitis, which is not a special disease but merely a part of chronic peritonitis. I cite these observations merely to emphasize the relative unimportance of the liver in the causation of an ascites that persists as long as, and necessitates as many tappings as, does the ascites in the cases at present under discussion. That recurring ascites occurs in the absence of congestive alterations in the liver is well illustrated also by the case reported by Hübler. In this case, as well as in a number of cases reported by Hale White and others, the serous membrane disease was confined to the peritoneum. Clinically these cases were the counterpart of many of the cases herewith tabulated, but at the necropsy the pleuræ and the pericardium were found intact. There was absence of congestive alterations in the liver, absence of connective tissue hyperplasia in the liver, but there were marked hyperplastic perihepatitis (zuckergussleber) and recurring ascites.

To RECAPITULATE: In a certain proportion of cases of chronic obliterative pericarditis ascites is the striking clinical symptom, and leads usually to the diagnosis of cirrhosis of the liver—whence the somewhat unhappy designation "pericarditic pseudocirrhosis of the liver," suggested by Pick, is not altogether inappropriate. Anatomically the distinguishing feature of these cases is a chronic fibrous (usually hyperplastic) inflammation of the several serous membranes of the body—a multiple serositis. In some cases the inflammation may remain localized to one or two serous membranes, but there exists a marked tendency for all the serous membranes to become involved. The several serous membranes may become involved equally or unequally; usually the lesions are most marked in the pericardium and on both sides of the diaphragm. In some cases extensive calcification of the pericardium occurs—the case herewith reported being the most marked example of this condition that I have ever encountered. In cases in which there is but partial obliteration of the pleural or the pericardial sacs there is usually also some fluid present. In many cases, however, not only is the

pericardium thickened and obliterated, but it has also formed adhesions with the chest wall and the structures of the mediastinum, one or both pleurae are thickened and obliterated, and the peritoneum is more or less thickened and adherent and contains a large quantity of fluid. In many cases the liver is adherent not only to the under surface of the diaphragm, but also to the stomach, the colon, the omentum, the anterior abdominal wall, etc. The lesions involve also the spleen, especially in those cases in which there are extensive adhesions in the left pleura. A distinguishing feature of the lesions is the development of thick fibrous, almost cartilaginous masses of connective tissue, that encase, compress, and often distort the organs, and give rise to an appearance suggesting confectioners' icing—whence the designation "iced liver" (zuckergussleber). In many cases of primary pericarditis the liver is enlarged, smooth, and has sharp edges; later with the development of the perihepatitis, the liver lessens in size, its surface becomes somewhat irregular, its edges rounded, and sometimes the entire organ becomes much distorted; still later or in some cases earlier the appearances characterized as nutmeg, with or without atrophic alterations, may supervene. Although some slight connective tissue proliferation and some extension of newly formed connective tissue from the thickened capsule sometimes occur, the common absence of marked connective tissue proliferation in the liver is noteworthy. In some cases the lesions of cirrhosis are encountered.

As already stated, the striking clinical feature of the disease is ascites, which is present whether the pericardial and pleural changes are absent, whether they are slight, or whether they are marked. However, the interpretation of the phenomena of the disease is much facilitated by recognizing that taken as a whole—from the beginning to the end—the symptom complex is made up of symptoms due to the serositis and of symptoms due to the disturbances or failure of the circulation induced by the pericardial part of the serositis. As a matter of fact, aside from the ascites, which occurs early, and may be the only symptom for many years, the symptoms are due almost entirely, if not entirely, to failing cardiac compensation. Expressing my own opinion, I should say that there can be little doubt that presenting the complex of obliterative pericarditis and ascites, there are grouped a number of cases that differ more or less in nature the one from the other. However, I believe that in the majority of cases the ascites is due primarily to the peritonitis and the perihepatitis; that in consequence of the inflammation, the peritoneum becomes a locus minoris resistentiæ; that in consequence of

the chronic pericarditis—in reality the pancarditis—the functional activity of the myocardium is interfered with; that in consequence of the lessening of the functional activity of the myocardium the circulation of the blood is more or less impeded—in some cases insensibly impeded; that the region that first manifests the sensible evidences of impeded circulation is the loens minoris resistentiæ—the peritoneum; that the relief afforded the general venous circulation by the accumulation of the ascites, probably indirectly, prevents to some extent the occurrence of œdema of the extremities; that the connective tissue hyperplasia of the liver in some of the cases is due to the same causes that induce the serous membrane inflammation—the irritant being carried by the lymphatics into the liver substance from the diseased capsule; and that in different cases the ascites is increased by the contraction of the newly formed connective tissue of the capsule, by the concomitant peritonitis in the transverse fissure of the liver should it compress the vessels (which occurs rarely if at all), by the marked congestion and its consequences, by concurrent cirrhosis (which is unusual), and by the general failure of the circulation toward the close of life.

Thus, although the disease is characterized by slow, insidious, and intermittent course, the perihepatitis and the peritonitis dominate the clinical picture of the well-developed disease. Aside from this, that is, aside from the ascites, the clinical picture varies, depending upon the point of origin of the disease. In some cases the disease is ushered in with acute pericarditis, pleuritis (which may necessitate repeated tappings), or perihepatitis (circumscribed peritonitis), which subsides and leaves the patient apparently well for a number of years. Usually, however, the lesions of the pericardium and of the pleuræ are latent, and the first sensible evidence of the disease is ascites. In some cases of primary pericarditis slight and transient œdema of the legs may be present clearly, but this is not observed in many cases, inasmuch as the pericarditis is usually latent. When œdema does occur early it usually soon subsides and does not recur until the ascites has been present for a long time or until shortly before death. Except shortly before death it is inconspicuous when contrasted with the excessive ascites. (Reference is not made in this communication to that class of cases in which general failure of the circulation occurs early and in which œdema and ascites develop pari passu.) Associated with early œdema, slight swelling of the spleen and disturbances of the gastro-intestinal tract may develop, but these usually subside with the ascites, and the disease, as a rule, is characterized by the entire absence of such symptoms until

shortly before death. The ascites is characterized by the fact that it is excessive, that it necessitates repeated tappings, that it recurs rapidly after tapping, and that it may remain stationary (not necessitating tapping) for many years.

In a few cases lesions of the peritoneum appear to be entirely absent, whereas, in other cases they are so slight as to appear inadequate to cause the ascites. These cases may be likened to the similar cases of valvular disease of the heart in which disproportionate ascites is the striking clinical feature. In these cases the ascites is doubtless due directly to the congestion of the liver and its consequences, as maintained by Pick. In some cases both factors—the congestion of the liver and the peritonitis—are operative; in some cases rather the congestion of the liver, in other cases rather the peritonitis. In cases in which the congestion is the major factor we should expect more or less swelling of the spleen and disturbances of the gastro-intestinal tract; in cases in which the serositis is the major factor, we should expect an absence of such symptoms. Some distinction—anatomically, at least—may be drawn between cases in which the lesions are confined to the peritoneum and cases in which the lesions are more wide-spread. The cases in which the pericardium is unaffected reveal no congestive alterations in the liver. Clinically, however, the two classes of cases are very much alike, and the "zuckergussleber" may occur in both.

In the diagnosis of this multiple serositis or of chronic adhesive pericarditis with ascites, especial attention should be directed to the history of a previous attack of acute pericarditis, pleuritis, or perihepatitis; to the early occurrence and subsequent disappearance of the œdema of the legs; to the marked ascites, with little or no œdema of the legs; to the enlarged liver early in the course of the disease (in some cases the liver appears not to have been enlarged), and to the small and distorted, but otherwise smooth liver, in the later stages of the disease; to the absence or very late occurrence of marked enlargement of the spleen; to the tendency to the occurrence of repeated attacks of pain, tenderness, rigidity, and possibly palpable and audible frictions in the right hypochondriac region—attributable to attacks of perihepatitis; to the rapid recurrence of the ascites after tapping, and to the physical signs of adherent pericardium—without which, it may be said, the disease is incapable of diagnosis. In the diagnosis of adherent pericardium most help will be derived from: a weak or absent apex-beat, especially in cases in which there is no increase in the area of cardiac dulness; systolic retraction of a considerable area about the apex; systolic

retraction of the base of the left chest posteriorly ; arrest of the normal respiratory movements in the epigastric angle ; imperfect descent of the apex-beat during inspiration ; inadequate or entire absence of shifting of the apex-beat, with change in the posture (lateral posture) of the patient ; absence of change in the limits of the cardiac dulness during the respiratory phases ; absence of increase of the cardiac dulness to the right, despite marked engorgement of the veins of the neck ; a diastolic shock or rebound of the heart ; evidences of dilatation or hypertrophy of the heart in the absence of valvular or other disease that might cause it ; absence of the characteristic changes in the heart in the presence of definite valvular disease—that is, absence of the usual hypertrophy of the right ventricle in mitral disease and of the left ventricle in aortic disease ; absence of pericardial effusion in the presence of pleural and peritoneal effusions ; paradoxic pulse—inspiratory diminution in the force and volume of the pulse ; diastolic collapse and inspiratory swelling of the veins of the neck ; and, as suggested by Musser, the non-occurrence in young subjects with valvular disease and cardiac insufficiency of the characteristic improvement following the administration of digitalis. None of these is pathognomonic of adherent pericardium ; all will not be present in every case ; but in many cases a sufficient number may be present to warrant the diagnosis.

Finally, this obliterative pericarditis with ascites may be distinguished from cirrhosis of the liver : by the aforementioned symptoms and signs of adherent pericardium ; by the absence of the etiological factors of cirrhosis of the liver ; by the slow, insidious, protracted, and intermittent course of the disease ; by the long periods of standstill during which the ascites may remain stationary and the patient in good condition ; by the entire absence or the transient presence of slight jaundice ; by the absence in most cases of portal congestion and gastro-intestinal disturbances—hemorrhage, diarrhœa, hemorrhoids, enlargement of the spleen, marked dilatation of the superficial veins of the abdominal wall, etc. ; in some cases, by the association of an enlarged, smooth, and firm liver, with marked ascites ; and by the fact that in many cases the patient survives a large number of tappings.

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DISCUSSION.

Dr. J. Alison Scott: I have been much interested in Dr. Kelly's paper, which seems to me to be a very clear exposition of a disease which perhaps in the future we may more readily diagnose. That this condition of the liver and peritoneum occurs without obliterative pericarditis I think has to be acknowledged, as Dr. Kelly has in his paper cited several cases. Two years ago I showed at the Pathological Society a specimen of syphilis of the liver, which I subsequently concluded was a true specimen of the zuckergussleber. The case was that of a man, aged about sixty-three years, and there were present the ordinary symptoms of true cirrhosis of the liver. He had been a hard drinker, and early in life had syphilis with the secondary and tertiary symptoms. Ascites had been recurrent, and there was rapid re-accumulation; five tappings removed between 250 and 300 pints of serum. He remained in the hospital several months, and died, as such patients usually do, of asthenia. The autopsy showed chronic diffuse peritonitis, with a considerable amount of light yellow serum in the peritoneal cavity. There was marked perihepatitis and much deformity of the lobes, due to the extension into the liver substance of fibrous tissue, and its subsequent contraction. There was no evidence of pericarditis; there was, however, slight pleural effusion.

In the case of a colored lad whom some of the Fellows here have seen at the University of Pennsylvania Dispensary, and whose symptoms have been discussed, there has been rather insidious but persistent ascites, with some swelling of the lower extremities. The liver is enormous. There is no evident valvular disease, but it is a question whether or not there is obliterative pericarditis.

Dr. David Riesman: Great credit is due Dr. Kelly for having brought order out of chaos. Anyone interested in these conditions has long felt the need of a summing-up such as has just now been presented to us. There is one disease in particular with which so-called pericarditic pseudo-cirrhosis may be confounded, and that is tuberculosis of the peritoneum. Türk has just reported seven cases, of which a diagnosis of tuberculosis of the peritoneum was made in five, in none of which was this found at autopsy. The disease must also be distinguished from tricuspid regurgitation, for in many instances of the latter the effusion begins in the abdominal cavity.

As regards the theories advanced in explanation of the distribution of the œdema, it seems to me unlikely that the condition of the liver is sufficient to produce the high degree of recurrent ascites found. Last year I made an autopsy in the case of a woman of about thirty-eight years, whose first symptom of illness had been hemorrhage from the stomach. All the conditions favoring ascites were present. There was a typical cirrhotic, hob-nail liver, and complete obliteration of the pericardial sac, but no ascites was found.

One point to be explained in the condition described by Dr. Kelly is, Why does the effusion begin in the abdomen and not in the lower extremities? Türk gives an explanation, which is somewhat as follows: The hepatic vein empties into the vena cava at right angles. When there is obstruction and retardation of the flow in the cava to the heart the hepatic vein will naturally have greater difficulty in emptying itself than the vena cava, as its flow is not direct, but at right angles. Individual anatomical conditions must also be considered, as all cases of adherent pericardium do not react alike when the heart becomes weak.

Dr. John H. Musser: I would like to ask Dr. Kelly if in the course of his studies he has found any cases showing acute infections of all the serous membranes. I have recently had a case under my care which presented in an acute form the phenomena which Dr. Kelly describes as occurring in chronic pericarditis and peritonitis. The patient was a man of fifty years who had pericarditis, pleuritis, peritonitis, and phlebitis, with myocarditis. He undoubtedly had a general infection of serous membranes. There was serum in the peritoneal cavity, in both pleural cavities, and a pericardial friction. A hyperleucocytosis and fever were present. The patient recovered partially.

In regard to chronic cases, I have seen two. One was a patient whom Dr. Osler frequently lectured upon, and, I believe, reported in full. The other was a patient whom I had seen frequently in private practice and later in the wards of the Presbyterian Hospital. In addition to the chronic pericarditis and mediastinitis he had extreme ascites, which required frequent tappings. I fail to remember the number of times which he had to be aspirated or the frequency, although it certainly was more than three times a month.

Dr. M. H. Fussell: The colored boy of eighteen, already referred to, came to the medical dispensary last fall with a ready-made diagnosis of enlarged liver. On examination there was found a markedly enlarged liver reaching to about on a line with the umbilicus. Ascites was present, which he had had for a long time. There was moderate œdema of both legs and the heart was enlarged to the right. The apex-beat was raised to the fourth interspace. There was very slight to-and-fro friction over the pulmonary cartilage; there was some pulsation of the external jugular and some tricuspid regurgitation, but no cardiac distress. Heaviness in the abdomen was the only symptom complained of. There was also a condition which we took to be pleurisy, a thickening of the pleura at the right apex. We looked upon this case and demonstrated it as pericarditis, giving rise to these various changes.

Dr. James Tyson: It has seemed to me that rather too much emphasis has been placed upon the etiological relations of the two conditions. This does not appear so strongly when Dr. Kelly's paper is heard to the end as from the initial sentences. It is not easy to understand why the results of

a weak heart, such as naturally follow from a heart embarrassed by pericardial adhesions, should differ from those due to a heart weak from any other cause, or why such a weak heart should especially favor transudation into the peritoneal cavity. It is not at all unlikely, as Dr. Kelly has suggested, that the ascites may be due to a serositis comparable to the serositis which produces peritoneal effusion.

Dr. J. Dutton Steele: In a series of papers appearing in certain Italian journals, by Villani and others, certain cases of cirrhosis of the liver have been reported in which effusion into the right pleura has occurred without ascites. Dr. Stengel and myself have endeavored to show that the hydrothorax of cardiac diseases affects more often the pleura of the right side, and that this effusion may occur before œdema of the feet.

Various explanations have been offered for these two forms of unilateral hydrothorax. The explanation offered by Villani is, that inflammation of the capsule of the liver, due to the congestion of the first stage of cirrhosis, spreads through the diaphragm and affects the pleura. The cause of the limitation to the right pleura of cardiac hydrothorax, as has been suggested by Dr. Stengel and myself, probably depends upon the pressure of the distended right auricle upon the greater azygos vein. At all events the right pleura appears to be somewhat closely connected with the diseases of the heart and liver, and it is rather surprising that in the cases reported by Dr. Kelly the left pleura is almost as frequently affected as the right.

Dr. Sherbourne Dougherty: I would like to ask Dr. Kelly if the acceptation of this symptom complex destroys as a pathological entity the so-called "chronic serous peritonitis." Several years ago I saw a case in which this was the postmortem diagnosis; the clinical diagnosis had been cirrhosis of the liver. There were pleural adhesions on both sides, but I do not recollect the condition of the pericardium.

Dr. Kelly: Dr. Tyson has referred to an important question in connection with these cases—namely, the difficulty in understanding why the results of a weak heart, such as naturally follow from a heart embarrassed by pericardial adhesions, should differ from those due to a heart weakened from any other cause, and why such a weak heart should especially favor transudation into the peritoneal cavity. The important fact is that in the class of cases that I have considered the peritoneal fluid is not due to the weak heart, at least not primarily and originally, but it is due to the serositis —the peritoneal inflammation. Were the contrary the case we should suspect, as I have pointed out in the paper, ascites rather than œdema of the lower extremities in all cases of lost cardiac compensation. This is a fact that appears to have been more or less lost sight of by Pick and others, as well as by Türk, to whom Dr. Riesman has referred. Dr. Riesman himself has mentioned an important fact in connection with these cases—that is, his case of obliteration of the pericardium with cirrhosis of the liver, but without ascites. In my paper I have rarely alluded to the occurrence of

such cases, having been unable to discuss them in detail. These cases indicate that, inasmuch as marked cirrhosis of the liver may occur without ascites, it is scarcely warrantable to ascribe a marked and continuously recurring ascites to a liver that is either unaltered or merely congested, that is rarely cirrhotic, and that when cirrhotic is usually of the so-called cardiac type. The important feature of the cases is the serositis; to this the ascites is due. Late in the course of the disease, with failure of the circulation, venous congestion may act as a contributory factor.

With reference to the involvement of the two pleuras the statement is usually made that the right pleura is much more frequently affected than is the left. In general this is true; it is true also in the cases that I have tabulated. But the disproportion in the frequency of involvement of the two pleuras is not nearly so marked in the cases that I have tabulated as it is in the class of cases concerning which Drs. Steele and Stengel recently have enlightened us. I fully concur with Drs. Stengel and Steele in their explanation of the unilateral occurrence of hydrothorax in their cases—which are largely if not wholly cases of venous stasis; I am inclined also to think that Villani is correct in his opinion regarding the occurrence of right-sided hydrothorax in cases of cirrhosis of the liver. In the cases that I have discussed, however, the conditions are different; the serositis is the important feature—a serositis that is progressive and that tends to involve all the serous membranes. It is because of the nature of the disease that the disproportion in the incidence of the lesions in the two pleuras is much less than it is in Dr. Steele's cases.

As suggested by Dr. Musser, many of the cases of multiple serositis run an acute course. It is to this class of cases that the Italians in particular have directed considerable attention. The scope of my paper, however, precluded more than passing reference to them. Referring to Dr. Scott's remarks, I may say that I have encountered several cases of marked zuckergussleber without similar lesions of the pleura or pericardium—notably one case associated with large gummas of the liver, evidently a case much like the one mentioned by Dr. Scott. But not to widen too much the scope of my paper, I excluded them from detailed consideration.

In answer to Dr. Dougherty's inquiry, I may venture the assertion that inasmuch as "chronic serous peritonitis" is at most a non-committal term, and inasmuch as in the case that he mentions several serous membranes were affected, these cases may readily be included in the class of cases to which I direct attention. Such inclusions would be all the more warranted were the lesions confined to the serous membranes, the underlying organs remaining intact.

NOTE.—Since the foregoing paper was read the following articles have come to hand: Becker, "Obliterative Pericarditis, with Hepatic Enlargement and Ascites," *Philadelphia Medical Journal*, March 25, 1902, vol. ix.

p. 485. Simon, "Zur Kenntnis der Zuckergussleber," Inaug. Diss., Königsberg, 1900; *Centralblatt für innere Medicin.*, 1902, vol. xxiii. p. 491. Pfannkuehe, "Zur Kenntnis der serösen Peritonitis und der Perihepatitis im Zusammenhang mit Perikarditis und Pleuritis," Inaug. Diss., Kiel, 1901; *Centralblatt für innere Medicin.*, 1902, vol. xxiii. p. 515. Nicholls, "On a Somewhat Rare Form of Chronic Inflammation of the Serous Membranes (Multiple Progressive Hyaloserositis," *Studies from the Royal Victoria Hospital*, Montreal, 1902, vol. i., No. 3. The article by Nicholls, which deals especially with the pathologic-anatomic features of chronic inflammation of the serous membranes, is the most exhaustive discussion of the subject that has yet appeared in the English language.

A CASE OF JACKSONIAN EPILEPSY CAUSED BY TUMOR OF THE BRAIN RELIEVED BY OPERATION; HEMIPLEGIA AND MUSCULAR ATROPHY; DEATH IN TEN MONTHS.

By CHARLES W. BURR, M.D.,

AND

WILLIAM J. TAYLOR, M.D.

[Read April 2, 1902.]

The interesting points in this case from the medical point of view are its duration—seven years—the late period at which the symptoms other than Jacksonian epilepsy appeared, and the occurrence of great muscular wasting on the palsied side after operation. The history is as follows:

W. W., an unmarried white man, aged twenty-five years, consulted Dr. Burr in February, 1895. His family history was very bad. His father died of some brain disease accompanied by mental symptoms. One brother was insane for years, and another died of some acute brain disorder. The patient's personal history was good. He had never had any venereal disease and had never used alcohol. He had received an excellent college education, and was filling a position requiring much intelligence when he was taken ill. He dated the onset of his illness from March, 1894, at which time he had an attack described as follows by a friend who was present: Suddenly, and while apparently in good health, the left hand and mouth began to twitch, speech became inarticulate, the jerking movements spread over the entire body, and he became unconscious. The sphincters did not relax, nor was the tongue bitten. There was neither somnolence nor headache after the attack,

which lasted about five minutes. During the following year he had seven similar attacks. Their duration varied from five to twenty minutes. They all began in the same way and followed the same course. He also had many attacks of momentary unconsciousness or partial unconsciousness without convulsions.

At my first examination he presented no signs of disease. He was a well-built, healthy looking-man. Gait and station were normal. There was no palsy of the cranial nerves, legs or arms. There was neither ataxia nor tremor. The knee-jerks were normal. The abdominal and thoracic viscera showed no evidence of disease. The urine contained neither albumin, sugar, nor casts, and was of normal specific gravity. His mental condition was good. He was somewhat depressed, but not more so than would be natural in a man who feared he was suffering from a serious malady. Speech was normal and his ability to write (he was right-handed) good.

Two weeks later I saw him in an attack. He suddenly stopped speaking. His eyes became fixed, looking straight forward. The mouth was drawn strongly to the left and the left hand became rigidly extended. Mouth and hand seemed to be affected synchronously. Still conscious, but speechless, he crawled from the sofa to the floor, and the tonic spasm extended to the left leg. In a moment the spasm became clonic and extended to the right side, but was not so severe as on the left, and he lost consciousness. The face was livid, the tongue bitten, the breathing stertorous, and he frothed at the mouth. He was unconscious about one minute and the entire attack lasted about five minutes. After it was over he remembered questions I had asked him at the beginning, and was able to tell how he came to be upon the floor. He had no headache or somnolence after the attack, and was mentally clear.

Dr. Thomas H. Fenton examined his eyes on February 23, 1895, and reported :

" I saw the patient first in March, 1894. The ophthalmoscope showed finer definition defective throughout, optic disks good size, liberally capillarized, but showing some quadrants of pallor, and with degenerating borders ; vessels easily emptied by pressure on globe ; slight hypermetropic astigmatism, visual acuity, with and without glasses, good ; muscular balance somewhat weakened, insufficiency both lateral and vertical ; field of vision for white good, for colors markedly

contracted. I made a correction of his optical defect, and three months later found some improvement in the color and definition of the fundus, noting, however, that there was still degeneration of the borders of the optic disks."

On March 15, 1895, Dr. Fenton reported further:

"I have taken his fields again with extreme care, and enclose a copy. I also went over his muscles, but I find no disturbance of muscular balance. The ophthalmoscope shows, especially in the right eye, some slight tortuosity of the superior vessels, with a disturbance of the definition of the visual margins. There is no marked alteration in capillarity. His pupils are fairly active and show nothing noteworthy; his visual acuity is up to the standard for near and far, with and without correcting lenses. I think the fields are really more contracted than is shown in the diagram. They are symmetrically correct, but I think they would bear general contraction."

In February, 1897, Dr. Archibald G. Thomson examined his eyes and found the fundus normal.

He was treated with many drugs with little result. The major convulsions occurred at irregular intervals, sometimes several in a month, sometimes none in several months. The minor attacks of momentary unconsciousness occurred daily, and sometimes oftener. Rarely was he free from attacks of either kind for several weeks. In February, 1900, he had an attack lasting several hours, in which the only symptom was continuous twitching of the left hand. Dr. Thomson examined his eyes again on February 23, 1900, and found that "in the right eye the veins were just becoming a trifle enlarged. There was possibly the faintest evidence of swelling of the disk which was hardly present three days before. In the left eye there was decided evidence of neuritis, especially on the nasal side. As you know, afterward the swelling of the disks developed very rapidly, producing a swelling of 6 or 7 D. in a few weeks."

In the latter part of February he began to complain of headache. He described it as stabbing and shooting, but could not localize it definitely. It would come on suddenly, last for hours, and pass off gradually. In May his eyesight rapidly failed on account of the rapidly increasing choked disk in each eye.

My diagnosis was tumor of the brain. As long as he presented no

other symptom than Jacksonian fits I was unwilling to make a positive diagnosis as to the nature of the trouble, but when headache and choked disk were added I felt sure of the existence of a tumor. Its location was more difficult to determine. The motor cortex itself, or the white matter immediately under it, could scarcely be the primary seat of the disease because of the entire absence of palsy. The preservation of sensibility in all forms, and of the stereognostic faculty excluded the region immediately posterior to the motor area, or, if we accept the motor cortex as being also sensory, then the preservation of sensibility helped to exclude the motor cortex. On the other hand, it seemed the tumor must be situated near the motor cortex or the convulsions would not all have begun locally. A tumor situated at a distance may cause a fit which begins locally, but scarcely a whole series extending over years, all of which begin in the same extremity and run the same course. Hence, I located, for operative purposes, the tumor in the prefrontal lobe, adjacent to but not invading the motor area. A meningeal tumor over the motor area could also have caused the symptoms. As the patient was rapidly growing worse, the headaches becoming more frequent, and the eyesight dimmer, I sent him to Dr. William J. Taylor, who admitted him to the Orthopædic Hospital and Infirmary for Nervous Diseases in June, 1900, with a view to operation. Dr. Archibald Thomson examined his eyes on June 6th, and reported:

"Pupils are equal and react normally. The media are clear. There is marked choked disk in the eye, the swelling about four diopters, with several small hemorrhages over the disk. No hemorrhages apparently in the fundus. The form and color fields are normal. No hemianopsia. At present he does not have any diplopia for distance, but during his illness he complained a great deal of it, although no apparent squint. As he finds it much more difficult to turn the eye to the right than to the left, I take it that he has a weakness of the right external rectus and that when he had his diplopia it was due to a paresis of the right externus."

On June 12, 1900, he was operated on by Dr. William J. Taylor, who will discuss the surgery of the case. Immediately after the operation there was a left-sided hemiplegia, including the face, with hemianæsthesia to touch. Deep pressure he could feel, but could not localize. At first he was speechless, but on the following day he could use single words, though he frequently made mistakes. Some days after the

operation the disks were much less swollen and vision had greatly improved.

On the day of his discharge from the hospital, August 6, 1900, he could feel touch, but could not tell whether an object were sharp or blunt. A deep prick he felt as pain, and deep pressure was felt distinctly. There was beginning contracture of the left wrist. Wrist clonus was present on the left side, ankle clonus was absent. The left arm was completely palsied. He could move the left leg a little by action of the hip muscles. Speech was very slow. He neither misused nor mispronounced words, but said he was compelled to stop to think of them. One week after leaving the hospital he had a convulsion affecting the right side only and not accompanied by unconsciousness. (This was the only convulsion of any kind after the operation.) He slowly improved, and on September 4, 1900, his condition was as follows: He could walk, but with distinctly hemiplegic gait. He could slightly flex and extend the forearm and lift the arm a little by the shoulders, but could not move the fingers, which were strongly flexed upon the palm. There was slight lower left face palsy. The tongue protruded straight. There was wrist clonus and ankle clonus on the left side. The left biceps tendon-jerk was increased. The right knee-jerk was a little too active, the left was very spastic, that is, it was quick, rapid, and the foot did not fall, but was pulled back. Tactile sensibility was normal on the face and somewhat blunted on the left leg and arm. He understood all that was said to him, and could read aloud slowly but understandingly. He could write correctly without difficulty, but had trouble in spelling words aloud. On September 21st he was seized with pain in the frontal region, lasting several hours. He had many similar attacks of headache, in all of which speech was greatly affected, but without increase of palsy. Sometimes the headache was followed by coma lasting several hours without convulsion. In October he began to retrogress rapidly, and by the end of the month he could not walk nor move the arm, and at times he was mildly delirious, at others in coma for several hours. In March there was absolute palsy of the arm and leg, and some palsy of the lower part of the face. The palsy was flaccid and without the slightest rigidity. There was great muscular wasting in the left forearm and hand, some, but not so marked, in the calf, thigh, and shoulder. The wasting came on acutely. The biceps tendon-jerk was very active on the left side. The knee-jerk was scarcely present on either side. Wrist and ankle clonus were absent.

On the right there was a slight normal plantar jerk, on the left none. There was complete insensibility to touch, pressure, temperature, and pain on the left arm and leg. The anæsthesia was not bounded by a distinct line, but faded off on the shoulder and neck. On the face sensibility was normal. He was almost blind. The pupils were widely dilated. The bowels were moved only by injections. The bladder was incontinent. The attacks of coma became more frequent, and he finally died in one on April 25, 1901, seven years after the onset of the trouble. A necropsy could not be obtained.

Notwithstanding the absence of a necropsy there is much that is interesting in the case. Though Dr. D. G. McCarthy's and my own microscopical examination of the tissue removed at the operation failed to reveal any evidence of tumor, still I think a tumor was present, but deeply seated. The inflammation present in the part removed may have been caused by a tumor in the neighborhood. The only other diseases that could have caused the Jacksonian fits are idiopathic epilepsy, Bright's disease, and chronic lead-poisoning. The last two were excluded by repeated and careful examination for the other signs and symptoms. In idiopathic epilepsy the fits may in rare cases begin locally, but choked disk never occurs. Surely Jacksonian fits, choked disk, and headache of the kind this man had are sufficient grounds on which to base a diagnosis of tumor. At the operation we were misled by the pathological appearance of the brain, and removed an area of inflammatory tissue, leaving the tumor behind. This is an error which has been made before, and which will occur again.

The muscular wasting is of interest because the influence of the motor cortex on muscular nutrition is still undetermined. In the hemiplegias of infancy there is often retardation of growth upon the palsied side, affecting not only the muscles but also the bones. Not infrequently in hemiplegia occurring in adults there is a gradual decrease in the volume of the paralyzed extremities, and especially the arm. This is always slow in progress, never reaches more than a moderate degree, and is not a true atrophy. It is brought about by disuse, exercise certainly being a stimulus to muscular nutrition, and probably by the smaller volume of the blood, the circulation being less active in palsied parts. There is also sometimes less subdermal fat on the hemiplegic side in cases of old palsy. The wasting in our case was of an entirely different and much rarer kind. It was a true melting away of muscle

fibres. It came on acutely nine months after the operation, progressed very rapidly, picked out individual muscles, or rather groups of muscles, in the forearm and hand especially, and with its appearance the contractures disappeared and the deep reflexes were abolished. It is curious that the knee-jerk on the right side was greatly diminished at the same time. The absolute anæsthesia antedated the wasting, and it is probable the two conditions were independent of each other. The wasting resembled that which occurs in acute disease of the anterior horns of the spinal cord.

In recent years quite a number of cases of muscular atrophy occurring in central palsies have been reported. The nature of the disease seems to be of no importance. Wasting may occur after hemorrhage, embolism, or thrombosis, and during the course of a tumor. The location of a central disease also seems to be of no importance, provided it is somewhere in the motor tract. Wasting may follow disease in the basal ganglia, the white matter, or the motor cortex. The duration of the cerebral disease is of some importance. Usually the wasting occurs some weeks or months after the onset of the primary disease, and it may come on at an even later time. A few very early cases have been recorded.

There are several theories to account for true muscular atrophy in cerebral palsy. Charcot held that the descending degeneration of the pyramidal tracts is continued into the anterior horns. But later investigations have shown that there may be atrophy without descending degeneration. Another theory is that the motor cortical cells and certain cells in the basal ganglia have trophic functions. Some authors explain the matter by saying that there may be a dynamic disturbance of the anterior horn cells without visible disease. The weight of evidence is in favor of the opinion that the cells of the anterior horns are the true trophic centres of the muscles. The percentage of cases without evident spinal cord disease, never very large, is growing smaller with improvements in the methods of examination. If the motor cortex or the basal ganglia exerted a trophic influence the cases should be common instead of rare. The fact that total transverse lesions of the spinal cord high up are not followed by wasting of the legs, unless there is also disease of the lumbar swelling, is also against the existence of a cerebral trophic muscular centre. The whole matter is as yet too obscure for dogmatic statement. Though it is probable that there is always disturbance of the anterior horns, how cerebral disease causes it is unknown.

Apart from these cases local atrophy from traumatic neuritis is not uncommon in hemiplegia. My impression is, though I cannot prove it by statistics, that the nerves in palsied parts are more susceptible than in health. We often see a trifling injury to the shoulder, which in a healthy man would soon be recovered from, followed in hemiplegics by neuritis and atrophy. Local atrophy may also be caused by the neuritis associated with the arthritis which occurs in hemiplegia. Indeed, arthritis has been claimed to be the cause of the general wasting, but this seems hardly true.

Another rather unusual point in the case is the long duration of the disease, from March, 1894, until February, 1900, before any other symptom other than the fits appeared. As a rule, the march of cerebral disease is much more rapid.

Operation, June 12, 1900, by Dr. William J. Taylor.

A large osteoplastic flap in the right parietal region over the Rolandic area was made by means of Pyle's chisels. The time consumed in opening the skull was thirty minutes. The dura was very tense, but more so over the site of the supposed tumor. There was no pulsation when the dura was opened, but there was great tension, and when the dura was cut and turned down a mass of brain tissue immediately presented itself in the pre-Rolandic region and pushed outward to such an extent that it was presumed to be a tumor. The exact topography of the brain could not be definitely determined, as the amount of tension and protrusion of the substance of the brain prevented it. An effort was made to enucleate this protruding mass, but it was found to be impossible, as it had no distinct outline. A large mass, however, was taken out, partly by cutting and partly by scooping with the fingers and a spoon, the whole mass removed being about the size of a small hen's egg. This did not have the same feel as the surrounding tissue, being distinctly more dense and easily separated. It was immediately put in 5 per cent. formalin for microscopical examination. The hemorrhage at a few places was quite profuse, and especially where the larger veins of the pia were torn. This was controlled by silk ligature, and the oozing from the surface and from the cavity from which the brain tissue had been removed was easily checked by a small amount of iodoform gauze packing. The dura was then carefully sutured with silk, the iodoform gauze removed, and the whole wound in the dura accurately approximated except at the anterior border, for

here the pressure of the underlying brain tissue was so great that this could not be done. The wound was then closed by silkworm-gut sutures. Following the operation his recovery was continuous and uneventful. His temperature, at no time high, speedily reached normal, and although for a number of days there was quite a free discharge of blood and broken-down brain tissue, this gradually lessened until it finally ceased. His appetite was good, he slept well, and had only occasional twinges of headache. Following the operation there was total palsy of the left side. He was examined daily from the neurological stand-point by Dr. Burr, who tested him both as to sensation and reflexes. Surgically he was well in ten days.

For the slight pains in his head he was ordered inunctions of mercurial ointment, which had in the past relieved him.

The pathological findings in this case have been to me most perplexing, for I was quite certain we had had to deal with a subcortical infiltrating growth, and so believed until the report of the microscopical examination was made. The brain bulged immediately the dura was opened, and it was thought that the protruding mass was more dense than the surrounding cortex. The gray matter was discolored, not normal in appearance, and, although there were no distinct limits to this supposed growth, it separated easily and seemed of different texture.

This apparent change in the cerebral substance must have been caused by the congestion of the intracranial pressure and to the manipulation during the operation. I firmly believe a tumor was present in the deeper structures, but of such a density that it gave no evidence of its presence by palpation.

Some years ago, in assisting Dr. Keen in an operation upon a case of tumor of the cerebellum, search was made in various directions with a probe, and no difference in resistance or density whatever could be demonstrated, yet at the death of the patient some six weeks afterward a large sarcoma was found and in such a portion that the probe must have passed completely through it in several directions. I have never yet seen such a condition of tension and protrusion of the cerebral substance after the dura was opened, unless a distinct new-growth was found at subsequent autopsy. I regret extremely that no examination could be obtained in this case to demonstrate the correctness of this assertion.

The cortex and the substance of the brain are both so extremely sensitive to the gentlest manipulations, and changes in their color and appearance occur so rapidly, that it may be difficult to say positively at the time of operation whether there be true pathological changes. This was the case in one instance where the amount of intradural pressure was so great that the cortex was lacerated by being pressed against the cut edge of the dura, and it was only after some of the bruised tissue was placed under the microscope that its true nature could be absolutely demonstrated.

Certainly we have very much yet to learn concerning the conditions found in these cases of suspected cerebral new-growth and of the macroscopical appearance of the cortex and underlying tissues.

Remarks. There are certain points in the surgical treatment of tumors of the brain, and particularly in the technique of operation, which are of great interest.

An osteoplastic flap which makes a large opening in the skull should always be employed. This permits of careful examination of the dura before it is opened and before there is bulging of the brain. In cases of great intracranial tension this permits of the examination of a wide area, and can be done almost as quickly as if the opening were made by a large trephine (from one and one-half to two inches in diameter). It gives greater space in which to work, and does not necessitate the use of a rongeur forceps to cut away the edges of the bone. It enables this bone flap to be replaced, thus covering the opening in the skull with a solid protection, and prevents the danger of injury to the brain by subsequent accidents. A small trephined opening should be made at one of the angles of the incision to test the thickness of the skull, and when this is ascertained the chisel may be used with greater speed and without danger of doing damage to the dura. The electric engine, if of sufficient power, is the ideal method of making this flap, and the reason why it is not more generally used is from want of familiarity with it on the part of the surgeon. The objections which have been raised to it have been the danger of sepsis, but this I consider easily avoided by care in manipulating the machine, and the difficulty in controlling the speed and movements of the cutting instruments. The use of the chisel and mallet is undoubtedly very satisfactory, but has several disadvantages. The first is the length of time which it takes to open the large flap in the skull—this varies, according to the thickness of the bone, from thirty to fifty minutes, working as rapidly as it is safe to do

—because we must bear in mind the possibility of the chisel slipping through and wounding the dura and brain. Although it is said that the hammering of the mallet and continual tapping and knocking against the bone does no harm, I cannot see why damage is not done if this is kept up for any length of time. We know what severe headache and how much disturbance would be produced to our own heads if such a method were used, and I think anything that will get rid of this is a distinct advantage.

Hemorrhage of the scalp is frequently very severe and often difficult to control, and particularly is this the case in dural growths, where just the opposite condition would be expected. Usually hæmostatic forceps are sufficient, but it is my intention in the next operation for suspected dural growth with great congestion of the vessels of the scalp to use catgut basting threads to control the bleeding from both sides of the incision in the scalp. Horsley's bone putty is of the greatest value in controlling the bleeding from the bone, and may be used freely while the chiselling is being done. New-growths of the dura in my experience have always been accompanied by a very congested scalp, from which the hemorrhage is most profuse, and it is very pronounced also from the vessels in the dura and from the small penetrating vessels between the dura and the inner surface of the skull. I have seen but one case of new-growth of the dura, and that a fibroma of many years' standing, recover after operation. All the others, now a considerable number, have died of hemorrhage, none living longer than eight or ten hours after the operation, and yet this is remarkable, as in all of them the growth was absolutely limited, not attached to the substance of the brain itself and easily shelled out. On the other hand, I have seen case after case recover where the growth was infiltrated and deep in the substance of the brain itself, and I always feel that the chance of operative recovery in these cases is very good, but the likelihood of recurrence and ultimate destruction of the patient by the growth is, of course, very certain.

In the future I propose in all instances of dural growths to baste the edges of the wound in the scalp, to open the bone quickly with a chisel, or, preferably, with the electric engine, and raise a large osteoplastic flap. Now, if there be much free hemorrhage from the vessels of the dura, and, as a rule, this hemorrhage is from all over the surface, and not from any one or two large vessels, I propose to pack the wound with several layers of gauze, replace the bone flap and bind it tightly to the skull and wait for a couple of days before proceeding to take out

the growth. At the end of this time the bone flap is again to be turned back, the dura opened, and the tumor removed.

I am quite confident that many cases of operation for brain tumor are unsuccessful surgically from our desire to complete the operation at one sitting, and that if we would exercise a little more care in guarding against hemorrhage, and especially venous hemorrhage, our results would be better. I have repeatedly seen death occur from venous hemorrhage from the dura and scalp; it is very difficult to control by ligature and clamp, and the prostration generally seems to be out of all proportion to the quantity of blood lost. In other parts of the body I have frequently seen much greater hemorrhage without the same collapse. The long-standing congestion incident to intracranial pressure seems to destroy the contractility of the vessels.

DISCUSSION.

Dr. F. Savary Pearce: The future of operations for brain tumor is growing brighter than at any time in its past history. I recall a case reported recently before the London Neurological Society, in which a boy of twelve years had a cerebellar growth in the right hemisphere. The tumor presented on the surface of the occipital bone. The disease had existed for five or six years, and there was the typical syndrome of cerebellar tumor (*i. e.*, choked disks, headache, cerebral vomiting, and titubating gait). After enucleation of the tumor the neuritis disappeared, the symptoms cleared up, and the boy got entirely well. The growth was a circumscribed fibro-endothelioma.

In a second case, a woman, aged thirty-seven years, there was a typical syndrome of tumor in the motor cortex, with choked disk and convulsions limited to one side of the body. Operation was followed by recovery, also a fibroma having been enucleated.

It seems to me that the surgeons are helping us much by performing early operations where diagnosis is fairly positive, and I hope the help will be far greater when we get the proper methods amplified, as described by Dr. Taylor. I should not hesitate to advise operative procedures for tumors not lying deep within the brain.

Dr. Wharton Sinkler: This patient was under my care for some time; in fact, he wavered in his allegiance between Dr. Burr and myself for sometime. He was at my clinic at the Infirmary for Nervous Diseases for several months. He had violent epileptic seizures, with headache. Ophthalmoscopic examination showed no changes in the eye-ground. One day when he

came to the clinic he had a seizure which was very readily studied from beginning to end, and was a true Jacksonian attack. He then had violent pain in the head, and an examination of the eye showed swelling of the disk. There was then no question but that there was a growth in the motor area.

Dr. William G. Spiller: I have observed that a tumor growing from the cerebral dura in the motor region may cause less paralysis than does a smaller tumor developing within the substance of the brain in the motor area. In one case under my care a dural tumor had caused great displacement and atrophy of the motor cortex, and yet the hemiparesis was not intense. The case reported by Drs. Burr and Taylor would seem to bear out the view of certain neurologists that the motor area is also sensory, inasmuch as the operation seems to have been confined to the motor area, and complete hemianæsthesia is said to have resulted. I have repeatedly seen muscular atrophy in hemiplegia, and this atrophy is not always from disuse. The different theories offered are not satisfactory. The theory of this atrophy as a result of arthritis, Dr. Burr has not advanced. This theory does not explain most of the cases.

Regarding degenerative changes in the cell bodies of the anterior horns of the spinal cord, secondary to degeneration of the pyramidal tracts, I have examined a number of cases to determine the correctness of this view, and have not found such degenerative changes, even in one case of infantile hemiplegia with intense atrophy.

I have also come to the same conclusion as Dr. Taylor, that a tumor growing from the dura is likely to cause a very bloody operation if removal is attempted. Dr. Burr has spoken of one attack of convulsions confined to the side of the body on which the operation was done. Has he an explanation to offer for this limitation?

Dr. Charles W. Burr: Answering the last remark first, I do not *know* why the man had a fit on the right side. I *think* the reason was that the growth at that time was beginning to grow again, to increase very much in size, and that it was really a general convulsion, not a true Jacksonian fit. Probably the motor cortex was pretty well gone. It apparently was a Jacksonian fit, but I think, in reality, it was a general convulsion.

As to the sensory area of the brain, I do not think this case shows anything at all. There was a big slice of his motor cortex taken off. I am also quite sure that when you take away parts of the brain you set up a considerable anæsthesia in the surrounding parts. On the other hand, the anæsthesia may be due directly to the motor cortex, and the motor cortex may be sensory. I do not know where the centre for sensation is, whether in the anterior or posterior motor cortex.

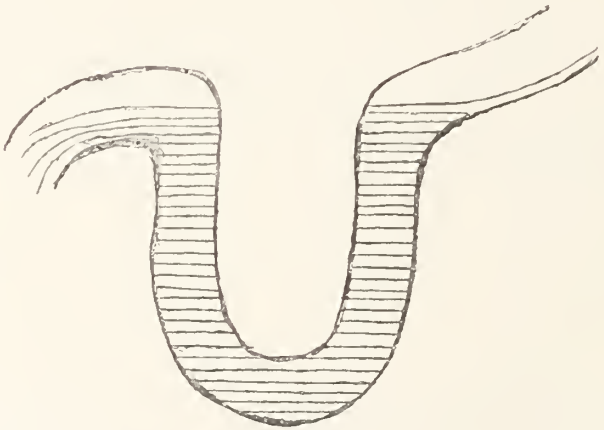
Local atrophy, especially around the shoulder-joint, is, I think, due to arthritis. That, however, I think only accounts for a few cases.

ON A POSSIBLE CAUSE OF METEORISM AND PARTIAL INTESTINAL OBSTRUCTION, WITH REMARKS ON THE USE OF ESERINE IN INTESTINAL ATONY.

By FREDERICK A. PACKARD, M.D.

[Read April 2, 1902.]

On November 2, 1900, I was asked to see, with Dr. D. E. Kercher, a woman, aged sixty years, with evident malignant stricture of the bowel and with intense tympanitic distention of the abdomen. In spite of a very large number of fluid movements in the course of each twenty-four



Diagrammatic representation of a loop containing fluid feces forming a plumber's trap.

hours, the abdomen had become steadily more distended, until, when I saw her, it was producing intense discomfort and interfering with respiration and cardiac action to an alarming degree. The uniform tympanitic distention prevented any very careful examination. The point that struck me as most peculiar was the fact that with many fluid fecal movements no

flatus had passed for many days. It was hardly conceivable that an ordinary stricture of the bowel could cause retention of flatus without retention of fluid fecal matter. The only explanation that seemed to me possible was that the patient had a stricture of the small intestine at a point where the feces were still fluid, and that on the proximal side of this stricture there was a loop of bowel so placed that it acted as a trap similar to that employed by plumbers to prevent the entrance of sewer-gas through the drain-pipes. This is best illustrated by a diagram such as that here shown. The existence of such a condition would permit of the overflow, so to speak, of fluid material that would effectually obstruct the passage of gas, unless the peristaltic force was sufficient to drive the fluid out of one arm of the U.

Acting upon this view, we gave the patient hypodermically 1/150 of a grain of eserine salicylate. This was repeated in two hours. After the second injection a large quantity of fluid fecal matter with a remarkable expulsion of gas occurred, while the abdomen became flat and soft. No further accumulation occurred, but the patient died from asthenia nine days after I saw her.

At autopsy we found not actually the condition which I had anticipated, inasmuch as the malignant stricture was in the upper portion of the sigmoid flexure. The plumber's trap arrangement of the intestine had occurred in the colon, the transverse portion of which formed a long loop dipping well down into the pelvic cavity. At the time of the autopsy this contained a considerable amount of fluid feces.

While I had never happened to see previously a case suggesting this explanation of partial intestinal obstruction, I felt that the explanation was such a simple one that it must have occurred to others. However, on carefully looking through the literature, I found nothing to indicate that such a mechanism for intestinal obstruction to flatus had ever been described. Finding that this was the case, I spoke to a number of my friends who are engaged in abdominal surgical work, to get their opinion upon the possibility of this being a frequent occurrence, and they considered my views as worthy of discussion. Now, after the lapse of a sufficient time and an amount of thought capable of preventing my drawing hasty conclusions, and after considering carefully what flaws there might be in the reasoning, I have decided to present this paper in order to call attention to what I believe may be a not infrequent cause of abdominal distention. I had hoped to have some further clinical and pathological data to substantiate my idea as to the occurrence of this

form of gaseous obstruction, but in the past eighteen months no second case of this kind has come to autopsy. I had also hoped to be able to procure experimental evidence of the action of such a loop, but I have been unable to complete this as yet.

The only objection that might be urged against this mechanism as a cause of intestinal obstruction is that the loop in the case I have mentioned in detail was directed horizontally when the patient was in the recumbent posture. This objection I do not believe invalidates the conclusion that I drew, because the loop filled with fluid would tend to seek a lower level than that of the intestine filled with gas on either side of it.

Cash (*Proceedings of the Royal Society of London*, 1886, vol. xli., p. 212) by an ingenious series of experiments showed that in the dog, onward movements of a body through the intestines by peristaltic action were stopped by a weight of from 8 to 10 grammes, and was markedly interfered with by a weight of 5 grammes. There are no facts to show the propulsive power of peristalsis in the human. On the other hand, there is no reason to believe that it is greater in man than it is in the dog. Therefore, the arms of the U need be of but slight length in order to contain a column of fluid of sufficient weight to remain immovable as a result of the peristaltic action of a paretic bowel wall. In other words, a loop, each arm of which will contain from 8 to 10 c.c. of fluid, would be sufficient to overcome by the resistance of this fluid the peristaltic action of the bowel. The loop so placed that its arms pointed upward would therefore effectually preclude the emptying of the bowel so long as this position was maintained. A loop having much shorter arms might be sufficient to obstruct the passage of gas, providing there was a sufficient supply of fluid material to keep the loop filled in spite of peristaltic contractions. It is easy to see why such a loop might readily form in the transverse colon. Possibly one of the functions of the longitudinal band of fibres, so plainly seen in the large bowel, is the prevention of such loop formation.

Such loops might follow adhesions resulting from any inflammatory condition of the lower abdominal cavity. These might remain symptomless until a weakening of the intestinal walls from some cause persisted to such a degree that the resistance offered by the

contents of the limbs was sufficient to cause accumulation. Such a loop might also follow the liberation of an incarcerated hernia or the matting together of two adjacent segments of the small bowel through tuberculous peritonitis.[1]

The condition mentioned above would evidently be aggravated by the administration of any remedies tending to render fluid the contents of the intestinal canal. In fact, I think it questionable whether the administration of hydragogue cathartics might not even cause the formation of such a loop if the bowel were paretic.

A case possibly also illustrating this condition came under my care a year ago at the Pennsylvania Hospital. On going on duty on April 1, 1901, I found a patient who had been admitted a week before with abdominal pain and intense distention, preventing a careful examination. This distention had persisted in spite of a fair number of bowel movements. On the day when I took charge of him he twice vomited yellow liquid material, having the same appearance and odor as had the bowel movements. The duration of the disease, his good general condition, and the absence of fever, leucocytosis and negative rectal examination, induced me to try the effect of eserine given in doses of 1/50 of a grain of salicylate at three-hour intervals. After one or two doses, large loose bowel movements occurred, the tympany subsided, and the vomiting, which had been previously troublesome, entirely ceased. Thereafter there was no return of his symptoms or signs; the bowels were evacuated daily, and the patient insisted on leaving the hospital. It is difficult to explain such a case as this unless we assume that there was some transient cause of obstruction to gas of a kind similar to that described above.

Another case illustrating the value of eserine in apparent atony of the bowel was admitted to my ward at the Children's Hospital on June 25, 1900. A boy, aged seven years, presenting slight evidence of rickets (rosary, sunken xiphoid, wide intercostal spaces, etc.), was brought to the hospital with a vague history of his having been sick two weeks with obstinate constipation. On admission, the abdomen was distended, the intestinal coils could be plainly seen, and there was slight diffuse abdominal tenderness. Rose spots (?) were present on the abdomen. His temperature on admission was $102\frac{4}{5}°$, and it was supposed that he was possibly suffering from typhoid fever, which was epidemic at that time. The temperature fell to normal three days after admission, and repeated examinations showed no agglutination of typhoid bacilli by the blood serum. In

[1] Since this paper was read, Dr. Rodman has written me of a case seen by him some time ago where such a loop was found at autopsy in a case dying after the relief of an incarcerated hernia.

spite of repeated enemata no bowel movement was obtained for three days, and then a very slight and insufficient evacuation. Although occasionally a little fecal movement was obtained after high enemata, there was no complete evacuation from the time of his admission until July 6th, when the abdomen was found to be greatly distended and everywhere somewhat tender. That there was not complete paralysis of the gut was evidenced by the presence of borborygmi. On the date last mentioned, vomiting set in, the vomitus consisting first of curds, and then of brown fluid, with the occasional appearance of blood. During the whole of this time the constipation continued. Owing to the obscurity involving the case I asked my surgical colleague to watch it. The distention was so great, and the vomiting so persistent, in spite of everything we could do to relieve it, that on July 9th my surgical colleagues, Drs. Le Conte and Jopson, saw the case with me in formal consultation. As the notes state, "he was placed on the operating-table, but the operation was deferred." This was because of our hope that still more energetic measures might relieve the obstruction, Two high enemata were given on this date, resulting in but one small yellow, constipated stool. On July 10th and 11th high purgative enemata were resorted to, consisting of magnesium sulphate, ℥j; turpentine, ℥ij; glycerin, ℥j; water, ℥viij.

Three of these were given on the 10th and two on the 11th of July, and produced no result except a little mucus. On the last day I ordered 1/50 of a grain of sulphate of eserine every fourth hour. At 4 A.M. on the following morning he had a liquid brown stool, and a second at 6.45 A.M. A purgative enema was then given at half-past nine in the morning, and by 1 o'clock in the afternoon he had had four soft brown and liquid stools, the first of which contained lumps of fecal matter. Feeling that there was probably more material to be removed, the enema was repeated at 2 o'clock, and resulted in the evacuation of four soft and liquid brown stools. On the next day the notes state that the boy had retained thirty ounces of milk, and that the abdomen was not distended and was very soft.

Whether this was an illustration of the condition described at the beginning of this paper, I cannot feel sure. I rather incline to the belief that it was a case of simple constipation due to intestinal atony of unknown causation.

Aside from cases of acute intestinal distention, eserine is apparently useful in the constipated habit of long standing, due primarily to weakness of the intestinal wall. I have lately seen a case which, among others, I think illustrates very clearly the occasional disadvantage of employing the ordinary laxatives which increase the bulk of intestinal contents. This man, aged twenty-eight years, for as long as he could remember had had obstinate constipation, with

intervals of three or four days without a movement unless medicine was taken. After taking a laxative he had intense pain, followed by a solid movement, and then a large number of loose movements, often occurring two or three times in the twenty-four hours for several days following. Physical examination showed nothing but a dilatation of the colon. If weakness of the wall of the colon was the cause of his constipation, increasing the bulk of the intestinal contents would theoretically not be the best way of causing the colon to empty itself. If there were already in the bowel a mass of material incapable of being moved, any laxative that increased the amount of the contents of the intestine would do harm rather than good, unless it was of such a character that it stimulated the sluggish bowel wall to react. What evidently took place in this patient was the accumulation of fecal matter in a large bowel not sufficiently strong to produce an evacuation unaided. When finally the bowel was made to move with the help of enemata or some very strong laxative, there was a tremendous amount of material in the distended colon that was only removed by many evacuations. The clearing out of the bowel was then again followed by constipation due to atony of the colonic wall. It was advised that temporary relief should be obtained by the use of glycerin suppositories, and the patient was told to abstain from all laxatives. Eserine sulphate 1/100 of a grain was prescribed morning and evening. During the month that has succeeded the adoption of this plan of treatment the patient has had one normal daily evacuation without pain or distention.

There is comparatively little in the literature regarding the use of eserine in human medicine, although for years Calabar bean has been used by veterinarians in abdominal colic in the horse. Bauer (*Centralb. f. die med. Wissensch.*, August 25, 1866) found that in cats alcoholic extract of Calabar bean produced a marked spasmodic contraction of the whole gastro-intestinal canal from the stomach to the rectum, frequent voiding of watery movements and later bloody mucus. So marked was its constricting action on the intestine that at the height of the cramp-like contraction the intestinal lumen entirely disappeared and the gut resembled a white, bloodless, rigid cylinder of the thickness of a quill. He believed

that the spasmodic contraction was produced by the direct action of the drug on the muscle-fibre of the intestinal wall. Laschkewich (*Virchow's Archiv*, 1866, Bd. 35, p. 291) found that in fatal poisoning with tincture of Calabar bean there was palsy of the sympathetic nerve and of the muscle of the intestinal wall. Such a late paralytic action is, however, frequently seen after drugs, poisoning from which in its early stages is accompanied by increased power in the parts later paralyzed. Bezold and Gotz (*Centralb. f. die med. Wissensch.*, April 6, 1867) confirmed the intestinal action described by Bauer in experiments with extract of Calabar bean and the sulphate of physostigmine. Westermann (Inaugural Dissertation, Dorpat, 1867; Abstr. in *Schmidt's Jahrbücher*, 1868, No. iii. p. 290) also confirmed these results, and found that the tetanic contraction of the intestinal wall occurred in from eight to ten minutes after poisoning cats, rabbits and dogs with a 2½ per cent. glycerin solution of the alcoholic extract. Curiously enough, he found that in rabbits the cecum was uninvolved, although the small and large intestine were thrown into spasm. He believed that the effect was due to disturbance of the sympathetic ganglia in the intestinal wall.

Subbotin (*Deutsch. Archiv f. klin. Med.*, 1869, p. 284) contributed an article upon the clinical use of extract of Calabar bean in atonic conditions of the intestinal canal. After drawing attention to the use of the drug in chorea and tetanus, he refers to its powerful stimulating action upon the nervous apparatus of all the organs supplied with smooth muscle fibres as well as upon that of the heart. He points out that the poison of Calabar bean stimulates the nerve centres and not the muscle fibres themselves or the nerve endings, since the contraction of the intestinal wall does not take place if their muscular elements are separated from the central ganglia in the brain by section.

He relates the case of a woman who had a tumor the size of the fist in the right iliac region, which twice disappeared after the employment of extract of physostigma. The cure was permanent so far as could be judged by the two years which had passed. He quotes a statement by Watson, that in a case of tetanus the use of the tincture of physostigma had been followed by a slight evacuation

where obstinate diarrhœa had previously existed. Subbotin had since seen two cases of atonic condition of the intestinal canal, to which he had given with good result $\frac{1}{8}$ gr., and in one case of long-standing bronchial catarrh, with marked dyspnea and expectoration, he had effectually employed it.

Schaefer (*Berliner klin. Woch.*, Dec. 20, 1880) reports five cases of chronic constipation and flatulence, and one case of ascites from heart disease with flatulent distention following paracentesis. In all of these Calabar bean produced a striking and beneficial effect. Hiller (*Deutsch. med. Woch.*, Feb. 28, 1883, p. 123) employed the drug for the relief of constipation and flatulence due to atony, in doses of $1\frac{1}{2}$ to 3 mg., given three or four times daily, and continued not longer than two or three days. He draws attention to the danger of using too large doses or continuing the use of the drug for too long a period, for fear of the production of continuous tetanic contraction with virtual intestinal obstruction. Maschka (*Berliner klin. Woch.*, April 9, 1883, p. 227) has recommended its use, not only in cases of intestinal atony, but also in chronic gastric catarrh, and even in acute intestinal catarrh. In the latter condition he believes that by causing contractions of the intestinal wall it relieves venous congestion with its attendant hypersecretion, and thereby lessens diarrhœa.

The next article that I could find dealing with physostigma or its alkaloid is by Traversa (*Il Policlinico*, January, 1899; Abstr. in *Centralb. f. inn. Med.*, Feb. 18, 1899, p. 192). This article deals with the physiological action of physostigmine. He proved experimentally that it acted peripherally on the motor apparatus of the intestinal canal, this action not being influenced by the exclusion of the medulla, vagus, sympathetic, and cœliac ganglia. He considers that the tetanic contraction is produced by a hastening of peristalsis. He found that the contraction could be removed by the administration of atropine, and that it did not occur in atropinized animals. The intestinal action of the drug, he states, is identical with that of pilocarpine.

Within the last few months a clinical article upon the use of the alkaloid has been written by von Noorden (*Berliner klin. Woch.*, Oct. 21, 1901, p. 1057). He states that he had used it for the past

year, and details the histories of five cases in which he had employed the drug to advantage. His first case was one of intense meteorism following a herniotomy. In some respects this case reminds me of the one which instigated me in making this report. His second case was one of double salpingitis, which developed intense tympany in spite of the passing of normal stools. This case was relieved by the drug after failure in obtaining relief from the rectal tube. His third case was one of appendicitis which, after operation, had enormous distention of the abdomen with gas, although the bowels were well opened. This one, also, was promptly relieved by the drug. The fourth case, one of typhoid fever with intense tympany, showed a diminution in the circumference of the abdomen amounting to 5 cm. after two doses of 1/90 of a grain of physostigmine (eserine). His fifth case was one of relapsing typhoid fever with hemorrhage, followed by meteorism, which was relieved promptly and safely by the drug. Von Noorden always uses the salicylate of eserine (physostigmine), because it can be well preserved in dry state and is readily soluble in five parts of water. He also states that it is best given in powder with milk-sugar.

DISCUSSION.

Dr. H. A. Hare: If I remember correctly, Dr. Packard reported some facts in regard to this interesting case before the Section on Medicine some time ago, and since that time I have on a number of occasions employed eserine for the purpose of expelling flatus from the bowel when it seemed to be accumulated sufficiently to be dangerous. In all the instances in which it was employed, however, I failed to perceive that it did any good. It is only fair to state, however, that these were cases of great abdominal distention complicating severe pneumonia in old persons, or typhoid fever, and in whom there was grave doubt as to whether sufficient degenerative change had not taken place in the muscular coat of the bowel to make any peristaltic movement impossible. I say this because I do not want my few experiences, which have been unfavorable, to discourage other Fellows from adopting this method, which I believe rests on a sound physiological basis.

In opposition to what I have just said about the failure to see the method do any good, I remember a number of other instances in which there has

been a tendency to enteroptosis with more or less dilatation of the bowel or stomach, in which the administration of eserine has been followed with excellent results. I do not know whether Dr. Packard meant to include in his eight quoted cases the one which I mentioned in *Keating's Encyclopædia*. Here great relief was afforded by full doses of the extract of physostigma. We all know that physostigma has been placed in laxatives and purgatives for the purpose of increasing peristaltic movement. After having these good results in the case referred to, and in one or two others, I fell into the error, common to all of us, of letting a good drug drop out of use for a considerable time. Dr. Packard renewed my interest in the drug, and eighteen months ago I again began using it. I have noticed since how frequently physostigma would act without any so-called laxative drug with it. I have found cases in which as satisfactory movement of the bowels could be secured by giving a pill of physostigma.

Dr. Joseph Sailer: I would like to ask Dr. Packard if any attempt was made to remove the mechanical obstruction by the posture of the patient? It seems to me that elevation of the lower portion of the loop by elevation of the patient's hips should have relieved the condition.

Dr. George E. Shoemaker: In regard to the mechanics of the case, it seems to me that the theory ought not to be confined to the fluid dropping to the bottom of the loop, but that it may be extended to a gas ascending to the top of the loop. It would be quite possible that a distended and atonic loop would be unable by peristalsis to move gas, and this is more probable than that a loop would be unable to move fluids unassisted by gravity.

Dr. Packard, in closing the discussion, said: In regard to Dr. Hare's remarks, aside from those cases which I have reported in the body of the paper, I have employed eserine in others, sometimes with success and sometimes without. Where the condition was undoubtedly one of gastro-intestinal atony I have practically always found that the drug acted well. I have never used it in the tympanitic distention of typhoid fever, partly because of the fact that I do not as yet feel as though I knew the drug thoroughly enough to certainly avoid danger of injuring the damaged bowel wall. I believe, however, that it might be easily possible to employ the drug in proper dose in the tympany of this disease without doing harm and with a good chance of benefit.

In answer to Dr. Sailer's question regarding change of posture in treating the patient whom I first mentioned in my paper, I regret that I did not try this, although I should imagine that if a loop full of fluid forms in the manner which I have indicated, the bottom of the loop would tend to sink to a lower level than the intestine on either side of it, no matter what position the patient might occupy.

I regret my inability to present to the meeting the results of some experimental work on this subject which I have started, but not com-

pleted. In order to test the theory I have had the transverse colon of a baboon brought down and fastened to the pelvis in order to make such a loop as I have described, and to test the effect of the administration of hydragogue cathartics. Dr. Le Conte kindly performed the necessary operation for me; but, owing to the delay in getting a suitable animal, too short a time has now elapsed to permit of my administering the cathartic for fear of rupturing the newly formed adhesions.

A CASE OF TYPHOID PERFORATION, WITH OPERATION.

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[Read April 2, 1902.]

The time is so short since operation in typhoid cases was considered justifiable, and the cases are yet so few in number, that even one of them may contribute to such future knowledge as shall make our position stronger in dealing with this most serious complication. Briefly stated, this was a typical case of typhoid fever, severe from the first, with profound toxæmia, wakeful delirium and active struggling resistance to all nurse attentions, deep excavating sacral bedsore and occipital cellulitis. On the twenty-fourth day perforation occurred in the early morning hours. Operation seven to ten hours later. The cæcum was punctured to relieve distention, and stitched. The typhoid perforation was then found and stitched. The patient was temporarily relieved, but died on the seventh day, six days and four hours after operation, the thirty-first of the disease, exhausted by the continuance of the malady. She was a girl of seventeen (German), who had a slight physique, but had never previously been ill. There was no organic disease. Her mother died of phthisis. She was cared for in her home, under the observation of myself or of Dr. Longnecker.

The diagnosis of enteric fever was clear. It rested upon nosebleed and the usual prodromes. There was right pelvic gurgling, the temperature rose steadily to about 106° on the fifth day, and continued high. There were present prior to perforation, tympany, spots, two to eleven characteristic stools a day, delirium, and typhoid facies. There was a thickened patch about the point of perforation. The

lungs and peritoneum showed no evidence of tuberculosis. The appendix was normal.

Treatment had consisted of cold sponging and packs. The diet was chiefly of milk and the medication symptomatic.

The type of disease previous to perforation was severe. The continued high temperature, a large, deeply excavating sacral slough forming early in spite of good nursing, and spreading in spite of all care, contributed to the exhaustion of the patient. Persistent wakeful delirium and active resistance to all necessary attentions by the nurse were at times associated with terror and screaming. The skin and subcutaneous tissues over the occiput nearly but not quite broke down; there was much subsultus and some retraction of the head.

If such be the condition of a patient previous to perforation, and if to this be added a chill, rise to 105.4, the onset of persistent expulsive vomiting of peritonitis, the drop in temperature, pain, excessive tympany obliterating liver dulness, and embarrassing respiration; if, after all this, a patient may live over six days from the time of arrest of peritoneal symptoms by operation, the future of typhoid perforation must be somewhat hopeful; as cases of less severity must surely have a better chance.

I conceive that there was in this case a preperforative stage lasting eighteen hours, from a period of chill and rise of temperature at 7.30 A.M. one morning to about 1.30 A.M. the next morning, when persistent pain and vomiting began. The operation was done ten hours still later, or within two hours of my morning visit and the making of the diagnosis. The small amount of local plastic peritonitis, in the absence of well-marked adhesions, found at the operation indicated that the inflammation was short-lived, and I cannot think that escape of intestinal contents had occurred twenty-eight hours before.

The symptoms present in what I have called the preperforative stage were: chill lasting forty minutes, followed by violent tremor, slight rise of temperature to 105.4°, followed by slow descent to 103°; pulse, 124–138; respiration, 32–36, as contrasted with a previous average temperature of 103°–104°; pulse, 110–114; respiration, 30–34. During the following day and evening once vomiting of curds and once a complaint of pain were noted. She was seen several

times, but as there was no increase in tympany, as bowel movement continued, as respiratory movement extended to the lowest portions of the abdomen and there was no local rigidity; as the single vomit of curd might have been due to a mineral acid, as the pain was transient, and as several times earlier in the disease severe pain had occurred, it was decided that the evidence of perforation was not conclusive at this stage. Reliance was placed on the respiratory movements, the absence of muscle rigidity, vomiting, and decided fall of temperature. At this time the ulceration was undoubtedly attacking the peritoneal coat at the point of later perforation, and nature was making a vigorous effort to head it off by an outside coating of lymph and possibly by an adhesive attachment. A frequently repeated white cell count during these hours might have shed some light, but it was not available. A single white cell count, unless decidedly above 15,000, is not very reliable as evidence. A steadily ascending count, as has been pointed out by Dr. Osler, would be significant if present. To have any value, this observation would require the almost constant presence for many hours of a physician, who was daily doing bloodwork and whose technique was good. Precious time may be thus wasted, especially if the early readings are negative. If, however, circumstances allow the gathering of this cumulative evidence, and if it is positive it has much value. The unreliability of a single white cell count in the diagnosis of acute abdominal disease is illustrated by a recent case where vomiting, rectal tenesmus, and left-sided pain, with some fever, were features of an acute exacerbation of a chronic catarrhal colitis, without any tubal, appendicial, or other visceral disease. White cells were 16,500. The most careful and repeated physical search, both before and after recovery, with and without ether, failed to show an inflammatory focus outside the mucous membrane of the bowel. The count fell in a few days to 6200.

To return to the case under discussion. Eighteen hours after the chill, steady pain began, soon becoming severe. A little later, at 4.30 A.M., she referred the pain to the right lower quadrant, and said she had appendicitis. Vomiting became persistent, greenish and expulsive, though four stools occurred in the night. The abdomen became more distended, and when the patient was seen at

9.30 A.M., liver dulness was gone, the face was anxious, the pulse harder at 134, respiratory movements in the abdomen had ceased on account of extreme distention arching from pubis to sternum. The diagnosis was probably equally clear for some hours before my visit. Operation two hours later beside the patient's bed, with the assistance of Dr. Walter G. Elmer, the ether being skilfully given by Dr. Worden. On opening the peritoneum for 3½ inches over the cæcum, much gas and some watery, brown fluid escaped. As nothing of leading character appeared, the presenting coils of ileum and a few inches of tensely distended cæcum were withdrawn through the wound. There was no evidence of peritonitis and some presenting omentum showed only some vein engorgement. These parts had evidently come from above the wound, and as they were not inflamed, and the point of departure in the search must be the ileocæcal junction, the necessity for returning them arose. The attempt to do this, of course, failed owing to distention. The cæcum was therefore nicked with a knife, and while water was poured over the parts, gas and feces were allowed to escape until the coils were flaccid, the nearness of the ileocæcal valve allowing gas to escape from the ileum also. This opening was at once whipped over by three layers of continuous silk, and the intestine returned with ease. The base of the cæcum being now found, the appendix was delivered and found normal. Tracing out the ileum from this as a starting point, an inflamed peritoneal region was reached about eight inches along the gut. Two or three square inches of thick, yellow, unorganized plastic lymph and injected peritoneum being found on nearby knuckles of gut. No adhesions requiring the slightest effort in their separation had yet formed. A well-defined perforation about one-eighth of an inch in diameter was found in the centre of a hardened patch, evidently a Peyer's patch, from which gas and liquid feces escaped. The near-by lymph was pulled off by the fingers and the opening closed by three superimposed layers of fine silk suture. The chances of other perforations being small no further search was made. As it was evident that there was no localization of gas and fluid which had leaked out before operation, the neighboring peritoneum was flushed. Iodoform gauze strips were placed in five different directions and a glass tube put in. Special care was taken to pack the

intestine away from the pelvic wall, as in appendicitis operation, and to place the sutured parts in this field so as to secure external drainage should sutures fail to hold. Two loose sutures supported the gauge packing, otherwise the wound was left open. Salt solution under right breast. Two hours after operation the pulse was 138, temperature, 99.2°; respiration, 40. Before operation the record was 134–100.8°–36. There did not appear to be much shock and the patient looked better. Temperature did not drop below normal, nor did it rise above 100° for twenty-four hours. The peritoneal vomiting stopped at once and never returned. The tympany almost disappeared for several days, and never again became marked. This was because letting gas out at the wound re-established free peristalsis, and flatus escaped freely. There was little pain, and that in the wound region. No effort to move the bowels was necessary, as much gas was passed the afternoon of the operation, and there were every day from one to four stools until her death from exhaustion on the seventh day following. There was never any fecal discharge or odor in the wound. All gauze was changed the third day, and clean intestine and omentum seen. Drainage tube out the fourth day. After this dressings dry. There was no pus. Urine was passed freely. But little nourishment was given during the first twenty-four hours, though it was rapidly increased, and by the fourth day she was taking three to four ounces of milk with whiskey every two hours. On the day of her death she took four ounces of milk three different times, and slept five hours; but in spite of salt solution under the skin, which caused temporary improvement whenever used, her strength gradually failed, and death occurred apparently from exhaustion, the typhoid process continuing.

The only available autopsy was through the open wound. The external dressing was dry and the light iodoform gauze packing was normally moist, clean, and sweet. Healthy, loose omental surfaces and intestine seen in the wound, which was, of course, still open throughout. No intestinal leakage had occurred from the sutured points which had been disposed in the wound area. No attempt at healing of the external wound. In cases which recover this occurs after the typhoid process has subsided. This girl would

likely have died of typhoid fever had she had no perforation. The operation simply prolonged her life six days, and would have saved a patient less seriously ill. It is encouraging that after the onset of peritoneal vomiting operation should be so well borne.

A few brief points as to the management of such cases: A patient cannot be moved to a hospital for operation. If in a private house this must be done at the bedside. Every effort must be made to save time in operating. There must be no handling of distended bowel outside the abdomen. Once escaped this cannot usually be returned without an amount of trauma which is most fatal. Inflamed visceral peritoneum splits and peels off with the greatest ease. A short incision of the bowel made under constant irrigation is by far the less of two evils, and may be quickly and safely repaired. An intestinal leakage has already occurred, so that the additional danger of soiling the peritoneum may be disregarded. The external incision should be located as for appendicitis. The point of departure for search should be the ileocæcal junction, as the majority of perforations occur in this neighborhood. If possible, the lateral abdominal wall should be made to form one side of the area packed and drained.

Infusion of salt solution is useful as a stimulant; it will tide a weak patient over dangerous periods of depression, and probably also assists in the elimination of typhoid products by the kidneys. The external wound should not be closed. Other things being equal, the patient most likely to recover will be the one to whom the least is done. Even establishing drainage along with a fecal fistula would be far better than prolonged manipulation, which is sure to kill.

DISCUSSION.

Dr. William Osler: The case is one of great interest and belongs to a special group that we have to put aside. They are the unfortunate cases that get well from the operation and yet succumb afterward to the intensity of the disease. The operation, of course, does not interfere with the disease. I know of nothing more distressing than that a patient should partially recover, having the wound healed, and subsequently die of an exacerbation or continuance of the disease. I think in making up the records of the

typhoid perforation cases these should go into a special group, because cases of this kind do not die directly from perforations. In future statistical considerations of typhoid perforations there ought to be three groups:

1. Those that die immediately after operation, directly from the effect of the perforation.

2. The smaller number of cases that recover, and

3. This group of cases that recover from operation, but subsequently die from continuance of the disease.

In reference to operation in private houses, some of you may have noticed the very interesting report from a young doctor in West Virginia, a few months ago, of a case which illustrates how a patient, operated upon even under the most unfavorable circumstances, may do well. In this case the operation was done in a miner's shanty, on a kitchen table, with only the assistance of the nearest doctor, who resided six or seven miles away.

With reference to the vexed point of leucocytosis as a diagnostic sign, I do not think there is any question as to its value when present, but it does not always occur. There may be perforation without any increase in leucocytes. But when we have a series of leucocyte counts and no leucocytosis, then when leucocytosis does occur it is of great value in showing that peritonitis and perforation have occurred.

Dr. James Tyson: I have recently had a case of perforation occurring in my wards at the Philadelphia Hospital. Operation was not done until over twenty-four hours after perforation occurred, and death ensued twenty-four hours later. The cause of the delay was the difficulty in establishing the diagnosis. Until more than twenty-four hours after perforation, which was indicated by sudden pain of moderate severity, there were no other symptoms except a leucocytosis. There was not a decided drop in the temperature. There was no tympany. There was, however, as intimated, a very decided and rapid increase in the white blood count, which rose from eight to seventeen thousand.

It was a want of thorough confidence in this sign, due to the fact that, so far as I know, sufficient cases have not been accumulated to show its conclusive value even after eliminating other infections, that caused the delay in diagnosis. I feel certain that if the diagnosis could have been made earlier, and operation done promptly, the chances of the patient would have been improved. I shall be very glad to learn from others how far the sign can be relied upon.

Dr. J. Alison Scott: For the past few years at the Pennsylvania Hospital we have been following the preperforative stage of typhoid fever very closely. The staff feels very anxious to have at least one case of recovery after operation, because the hospital as yet has the unenviable record of not having one case of perforation with recovery, except, perhaps, that of Dr. Hunt, who always said that he had typhoid with perforation that had cured itself. In the past year we have had some eight or ten per-

forations at the hospital. Only five of these have been operated upon. These cases illustrate very well Dr. Osler's views. In only one did the leucocytes go above 14,000. All of the cases had a leucopænia, having in the neighborhood of 3000 to 5000 leucocytes; in three cases after perforation they did not go above 7000 or 8000. There was pain with evidences of perforation, and subsequent to that the leucocytes again fell and reached 3000. Operation was performed under ether. Some of the cases lived twenty-four, some forty-eight, and one sixty hours, but all died, the physicians thought of peritonitis, although in one or two cases the surgeon thought not of peritonitis but from other causes. In at least three cases, therefore, out of four cases there was absolutely no evidence of leucocytosis with physical signs of perforation present.

Dr. R. P. McReynolds: I would like to report a case similar to that of Dr. Shoemaker's. I was asked to see the patient on Thursday evening by the visiting physician. The man had had typhoid fever for some weeks, and from the history given I think he must have had a perforation on Wednesday. When I saw him on Thursday he had general peritonitis and his condition was such that I thought any operative interference would be followed by death. His pulse was 120; respiration, 30. I therefore advised against operation. On Saturday I was asked to see him again, and at that time was much surprised to find that the general peritonitis had somewhat subsided, and that there was some evidence of a localized abscess in the right iliac region. I then advised operation. The wife opposed it, and I did not urge the matter, thinking the man's condition did not justify it. I again left the house thinking he would probably die. On Sunday I was asked to see him again. The abscess was now well localized on the right side, and permission had been given for an operation. I operated at the house upon the kitchen table, and found a well-defined abscess cavity filled with fecal matter and some pus. The cavity was flushed out with water and drained with gauze. The anæsthetic administered was chloroform, and only about two drachms used. It is now ten or twelve days since the operation, and the man seems to be in a good way to recover, but with a large fecal fistula which I think will close.

Dr. H. B. Allyn: During my last service at the Philadelphia Hospital I had a case of typhoid fever which illustrates the difficulty of making a diagnosis of perforation, and it may therefore be interesting in connection with Dr. Tyson's query. A man in the third week of typhoid fever developed pain in the abdomen, and passed ten ounces of blood. Two days later he had sudden, acute pain in the lower right quadrant of the abdomen, slight tenderness and some rigidity in the same region. Subsequently tenderness increased, the abdomen from being fat became distended, the percussion note over the cæcal region was impaired. A digital rectal examination disclosed resistance to the right. There was no collapse, but the pulse was 120, small and hard, the pupils were dilated, the patient

was very restless at night, and he was stuporous. The leucocytes rose from 6000 to 18,000 on the day of pain. The following day they had fallen to 14,000. The temperature gradually fell to normal in forty-eight hours. The surgeon was not willing to operate because he thought the signs were not sufficiently clear to warrant operation. The leucocytosis gradually subsided, the man's condition improved, and he finally recovered.

ANALYSIS OF HUMAN MILK THE BASIS OF THE ARTIFICIAL FEEDING OF INFANTS.

By ARTHUR V. MEIGS, M.D.

[Read May 7, 1902.]

On February 22, 1882, a little more than twenty years ago, I read before the Philadelphia County Medical Society an essay on "Milk Analysis." Subsequently I issued various publications upon the same subject and on that of infant feeding. In the course of my studies of the two subjects, which, from their nature are related to one another, I reached two important conclusions. First, that human milk never contains more than about 1 per cent. of casein; and, second, that the food of infants ought not to be changed in strength from month to month, as is commonly done. The amount of food should be increased, but no change should be made in its strength nor in its composition from the time an infant is born until it is from six to nine months old. The first conclusion was, of course, attained from milk analysis alone, while the second forced itself upon me during my investigations in analyzing human milk and as a result of what I observed in artificially feeding infants. The two propositions are of the utmost simplicity; but the question whether my position is correct will have to be ultimately decided by practising physicians. Physicians often take the ground that they are not expert chemists, and that they cannot decide questions of chemistry, and my two propositions belong to that branch of science. It often happens, however, that the final decision of intricate scientific questions rests with manufacturers who are entirely without expert knowledge. A man of science announces a conclusion in regard to some question that bears upon the manufacture of a product of

importance to the world of trade. The court of last resort is constituted by the manufacturers, who are quite ignorant of pure science, but who test the correctness of the conclusion by their efforts to improve their methods of manufacture. In a similar way the correctness of my two propositions must be ultimately passed upon by practising physicians who will judge them by the results they obtain in artificially feeding infants, which is not unlike manufacturing. The questions how much casein is contained in human milk, and whether the milk of the human female changes in composition from month to month during the course of lactation, have no practical interest except in as far as their solution can help to teach the best method of artificially feeding infants. For fourteen years I worked constantly in this field, but during the past six years I have left the subject almost entirely in the hands of others. I return to it now for the purpose of trying to get the two questions I have set forth brought to a state of stable equilibrium, which at the present time they are very far from having attained. I shall endeavor to abstain from much discussion of other points than the two especial ones, although there are many which are both of interest and of practical importance.

To make myself clear, it is necessary for me to say that I shall speak of the nitrogenized element of milk as casein. This is the old term, and it seems to me to describe what is meant as well as the words proteids, albuminoids, or any other one of the more modern names that have been introduced. The material is probably complex, and it will hereafter be shown, if this has not already been done, to be composed of several substances which are more or less dissimilar. Until its nature is better understood it is necessary to have a single term by which to designate it.

The conclusion that human milk never contains more than about 1 per cent. of casein was, as far as I know, original with me, and it was announced, as has already been said, twenty years ago. The correctness of this conclusion, which has had far-reaching effects upon the principles of the artificial feeding of infants, has never, I think, been much disputed. Minor differences of opinion have been expressed, but the broad generalization that human milk never contains much more or much less than 1 per cent. of casein has been

almost invariably accepted. It was only after I had spent a great deal of time in studying the literature of the subject and had analyzed many specimens both of human and of cow's milk, and of condensed milk, that my conclusion in regard to the proportion of casein in human milk was reached and the result announced. The older students of physiological chemistry made many analyses of milk, and the literature of the subject is extensive and will be found in several languages. I have examined treatises in French and in German as well as in English, and of the older literature I think the French is the best. The *Traité de chimie Pathologique,* par Becquerel et Rodier, Paris, 1854, for instance, is an admirable work. In all of the older published analyses of human milk there will be found to be the widest differences in the estimates of the amounts of casein and of sugar, while in regard to the amounts of the other three constituents—water, fat, and salts—there is practically no difference. The science of chemistry is in possession of such reliable methods of ascertaining the amounts of water, of fat, and of salts in milk that the results obtained can be depended upon to be exact. There is not now and never has been any difference of opinion in regard to the quantities of these three constituents contained either in human or in cow's milk.

The sum of the amounts of casein and of sugar in human milk is about 8 per cent. In the analyses that have been published no difference of opinion is found in regard to this sum, but when the separate estimates of the casein and of the sugar are studied the widest divergence is found in the various conclusions. Dolan and Wood give an analysis in which the casein is set down at 7.005 per cent. and the sugar 1.921 per cent., while Quevenne estimates the casein to be 1.05 per cent. and the sugar 7.31 per cent.[1] Other physiological chemists have published analyses in which the variety of conclusion in regard to the amounts of the two elements is almost infinite, except that they all agree that the sum of the two is about 8 per cent. What I have said has shown that the difficult part of milk analysis is the separation and the estimation of the casein and of the sugar. The other three elements—water, fat, and salts—are

[1] Arthur V. Meigs. Milk Analysis and Infant Feeding, p. 40. P. Blakiston, Son & Co., Philadelphia, 1885.

generally separated first, and the residue containing casein and sugar is dealt with last. Of the difficulties that are encountered in separating these two constituents of milk, I might say a great deal, but this would lead me into a consideration of questions that belong so entirely to chemistry that too much time would be consumed, and the discussion would not be likely to be profitable. It was not long after I began to study the subject of milk analysis before I reached the conclusion that it was in the estimation of the casein and the sugar that lay the difficulty of the subject, and, further, I soon came to believe that many of the analyses of human milk that had been published were incorrect. My own researches led me to believe in the correctness of the observation of Wanklyn, that milk is a fluid exhibiting great constancy of composition, and if this be true it follows that the great differences of the estimates of the amounts of casein and of sugar can only be explained by the conclusion that many of them are incorrect. If the various methods of analysis that have been employed for the separation of these two elements are studied the conclusion is unavoidable that many of them are incapable of yielding scientifically accurate results. This subject I shall not now fully discuss, for I have already done so in some of my essays, and I shall allude to it again in this one.

There is little cause for surprise that the estimates of casein and of sugar should be incorrect in many of the older analyses, but it does surprise me exceedingly that students of milk analysis and of infant feeding continue to publish analyses of human milk in which the casein is rated at high percentages. If such analyses ever are scientifically accurate, then it follows as a corollary that my conclusion, published twenty years ago, that human milk never contains more than about 1 per cent. of casein, is incorrect. As has already been said, the essential accuracy of this conclusion has never been seriously disputed, and yet it does not seem to be generally perceived that if it is correct it is quite as impossible that specimens of human milk should sometimes be found containing large percentages of casein as that human milk should occasionally contain only 40 per cent. of water, and this everyone knows is impossible. The reason probably that the fallacy of the position of believing in my doctrine of the invariably low percentage of casein in human milk,

and the acceptance at the same time as correct of analyses rating it high, is to be found in the fact that few persons who have dealt with the subject are both chemists and clinicians. The question has generally been studied by two sets of observers who approached it from totally different points of view, and the result has been the accumulation of two sets of facts that have very little natural relation to one another. The chemists have been working at one part of the problem and the clinicians at another, and the two have never been able to bring themselves into intimate relation. What I wish to state, and to state most emphatically, is that the accuracy of my conclusion that the casein in human milk is invariably of low percentage is quite incompatible with the acceptance as correct of the analyses which rate the percentage of casein high. Many of the essays published upon infant feeding, and even some of the text-books, contain analyses of human milk, but include no explanation of the methods that were employed in making the analyses, and even the names of the analysts are withheld.

It has been my endeavor to avoid as far as possible the introduction into this essay of purely technical questions of chemistry and to include only such things as may appeal to those who are interested in the clinical side of the subject, and especially in the artificial feeding of infants. In order, however, to make myself comprehensible in regard to an important point, it will be necessary for me to say something about the chemical methods ordinarily used in analyzing milk. I have already said that the only difficulty is in estimating the casein and the sugar, and that the differences of opinion in regard to the composition of milk are only as to the amounts of casein and of sugar. The water, the fat, and the salts are easily dealt with, and, therefore, I shall say nothing about the chemical methods by which they are determined. It is after the amounts of these three elements have been ascertained, and the chemist is left with a residue which for all practical purposes may be said to consist of nothing but casein and sugar, that the real difficulty in the analysis of milk is encountered. Almost all of the published analyses have been made by determining the amount of sugar in the residue and then rating the amount of casein by difference. To make myself perfectly clear, this is what has been done. A residue

consisting of casein and of sugar, which may be represented by the figure 8 (for I have already shown that the sum of the amounts of casein and of sugar in human milk is about 8 per cent.), is tested to ascertain how much sugar it contains, and then it is assumed that whatever is left is casein—that is, if an amount of sugar represented by the figure 7 is obtained it is assumed that the casein amount is one. This estimation of the casein by difference has always seemed to me to be most inadequate and unscientific. It is not necessary that one should be a practical chemist to perceive the opportunity for error introduced by the use of such a method, for it is patent to everyone. It is this: if all of the sugar is not extracted from the residue consisting of casein and of sugar, as much sugar as is left behind is thrown in with the casein, and the casein amount is overestimated by that quantity. Long ago I made up my mind that conclusive results could never be looked for from any method of analysis that determined one of the five elements of milk by difference.

One more statement and I shall have finished with the purely chemical side of the question. Almost all of the analysts of milk have availed themselves of the copper-reduction method for the estimation of the sugar. It is beyond question that this method is reliable for the estimation of cane-sugar when used along known lines, and when there is abundant opportunity to test and prove the accuracy of the results obtained. For estimating the amounts of milk-sugar the copper-reduction method has been comparatively little used except in analyzing milk, and milk-sugar is a substance which presents differences in its chemical attributes and reactions from cane-sugar. If it be recollected that the copper-reduction method when applied in milk analysis is expected to determine accurately the amount of milk-sugar in a residue containing at least one other organic substance (casein), in regard to the chemical reactions of which little is known, it will not be thought rash of me to question the reliability of the analyses made in that way. When it is further recollected that the casein is determined by difference alone, and that any error made in regard to the amount of the sugar necessarily entails a corresponding inaccuracy of the estimate of the cascin, it becomes evident that the findings of such

a method should only be accepted after they have been in some way proved.

The climax of this part of my subject is reached when I state that although the results of my analysis of human milk were published twenty years ago, and although their substantial accuracy has never been seriously called in question, no one, as far as I know, has ever made a single analysis by the method that I devised and described. The method is of the utmost simplicity, and is based upon that well-known attribute of casein, its coagulability by heat. By my method each one of the five elements of milk is separately determined and is weighed by itself. In order to test the accuracy of my conclusions in regard to the amounts of casein and of sugar I have had my pure sugar at the end of an analysis tested to ascertain if it contained any casein, and *vice versa* the pure casein tested for sugar. This is described in full in my book on *Milk Analysis*. My method is troublesome in one respect, it is very tedious, for it takes about three weeks to make one complete analysis. This, it seems to me, should be looked upon as a small matter in comparison with the importance of obtaining accurate results. It is from the results obtained by the analysis of human milk only that any general agreement can be attained with regard to the principles that should govern us in the artificial feeding of infants, and upon this depends year by year a multitude of human lives.

There is only one possible source of error that I can think of connected with my method of milk analysis, and it is that there may exist in milk some undiscovered nitrogenized substance which is uncoagulable by heat. If such a substance does exist it would be included with the sugar. It is for the future to decide, however, what the real nature of that element of milk is which has been heretofore called casein, or, if the names be better ones, albuminoids or proteids.

The second important practical conclusion that I have announced is that in artificially feeding infants the strength of the food should not be increased from month to month, as is generally directed. My own advice has been to use the same food from the time an infant is born until it is six to nine months old, but to gradually increase the amount. Most of the older analysts state that human milk increases

gradually in strength during the progress of lactation, and it would appear that this statement has been pretty generally accepted as correct. The natural way to decide the question whether the food of artificially-fed infants should be increased in strength, or if the strength should remain the same and the amount of food be increased as I have described, is to make analyses of human milk at various periods of lactation and learn whether it does increase in strength as time goes on. Afterward the final judgment will rest with clinicians, who will test the accuracy of the conclusion in practice. The question is difficult to decide only because of the uncertainty that remains in regard to the whole subject of milk analysis. No method of analyzing milk, as far as concerns estimating the amounts of casein and of sugar, has been shown to be certain in the same way that the results of the analysis of metallic ores are known to be certain. Until a method has been discovered and accepted which will yield results whose accuracy are beyond question there will always remain some difference of opinion.

When I was making analyses of human milk it of course happened that I obtained specimens from women who were at different periods of lactation, and it very soon struck me that there was no difference in the composition of the milk, whether the woman was in the early, in the middle, or in the last stage of her lactation. With the exception that there are differences in the amount of fat, all of the human milk I have ever analyzed has exhibited that constancy of composition that I have already said is one of the attributes of milk. It is not intended to say that milk does not show some difference from its ordinary state during the first few days of lactation when the colostrum is present. This is a subject which I have not personally investigated, as all of my analyses were made of the milk of women whose infants were already at least several weeks old, for my purpose was to obtain such an understanding of the composition of human milk as would help me to learn how to feed infants artificially. It may be almost positively stated as a fact that the milk of cows does not increase in strength from month to month, as it has been so commonly, and it seems to me upon insufficient evidence, supposed that human milk does. If cow's milk does not change in composition during the progress of lactation, from analogy it would

seem to be unlikely that human milk does so change. As soon as I had decided in my own mind that human milk does not increase in strength during the progress of lactation, I determined that in artificially feeding infants I should not change the strength of the food, but would increase the amount as the infants grew older. The manner in which this should be done is a subject that it is undesirable now to open.

In artificially feeding infants I have had such entirely satisfactory results when I have used a food of the same composition from the beginning until the infants were past six months old that I am fully convinced it is the best method that can be pursued. The question whether the food of artificially-fed infants should be changed from week to week or from month to month is a very important one, and it is astonishing to me how little interest it has appeared to excite. Although I published my conclusions many years ago, and although in subsequent publications I have frequently announced my continued adhesion to my original opinions, the subject is hardly ever discussed in the essays of any of those who write upon it.

In conclusion, I will recapitulate briefly what I consider to be the important points of my theme, and will try to indicate what may be done to secure better results from the artificial feeding of infants.

First, in regard to the analysis of milk, and of human milk in particular. As it is twenty years since I published a description of my method of analysis, and my conclusion that human milk never contains more than about 1 per cent. of casein, I think it ought not to be considered too much to ask that the portion of the scientific world interested in the subject should have my method of analysis tested and the question decided whether my conclusions have any value. It is the more necessary that this test should be made, because if my method of analysis is reliable it certainly follows that many of the analyses published are incorrect. If a thorough test should prove my method to be reliable it would necessarily follow that my conclusion in regard to the invariably low percentage of casein in human milk is also correct.

Second, it ought to be decided whether it is best that artificially fed infants should have the strength of their food increased at frequent intervals, as is generally advised. This question can be de-

cided only after many more analyses have been made, and made by a method of proved reliability. Afterward the relative merits of the two systems, that of changing the strength of the food and that of using the same food but increasing the amount, must be put to the test of experience.

DISCUSSION.

Dr. Joseph E. Winters, of New York: In the discussion of this important paper I shall take the liberty of referring briefly to the history of infant feeding, which to me is as fascinating as the history of vaccination. Like vaccination, it has been evolved and brought to its present state of perfection entirely and absolutely by the clinician.

The late Dr. J. Forsyth Meigs, who was the most successful physician of his time in the feeding of infants, found that a mixture of cream, water, and milk-sugar which agreed best with young children was, according to all published analyses of human milk, too weak to ensure good development, and yet clinically it was satisfactory.

As a great clinician, Meigs knew, as every great clinician to-day knows, that when laboratory results and bedside observation conflict, the clinical result must be right and the laboratory wrong.

The elder Meigs asked his son, Dr. Arthur V. Meigs, to make analyses of condensed milk. This afterward led to his analyzing human milk, with the result that Dr. Arthur V. Meigs published to the world the first correct analysis of woman's milk.

Arthur V. Meigs then devised as a substitute for woman's milk a cream mixture which would contain the same milk constituents as human milk, and in the same relative proportions.

The second point of interest in the history of the present development of infant feeding is that Mr. Gordon, a dairyman, read Meigs' book, and out of this grew the present system of laboratory or percentage feeding. All that is known to-day of accurate infant feeding in any part of the world stands as a monument to Dr. Arthur V. Meigs, its sole foundation being his accurate analysis of woman's milk.

Infant feeding having been placed on a scientific basis, *easy of attainment*, satisfactory to every painstaking physician, is in danger at the hands of its friends, sincere but impractical. It behooves the medical profession to contemplate these dangers.

Centrifugal cream is of chief moment.

For the production of centrifugal cream the milk is filtered through several layers of sterilized gauze and sterilized cotton, and cooled to a temperature of 38° F. It is then put in a Copenhagen Pasteurizer and the

temperature raised to 83° F.; then put into a centrifugal machine, which makes 6700 revolutions per minute, and again cooled to a temperature of 40° F. All this mechanical trituration causes a material alteration in the composition of the cream.

Contrast this with cream which has been produced under natural conditions.

When cow's milk is allowed to stand, the fat, being the lightest part of the milk, tends to rise to the surface, and forms a layer which we know as cream. This contains not fat alone, *but all of the constituents of the milk*, and is, therefore, *simply milk containing an excessive amount of fat.*

Each fat globule by molecular attraction is surrounded by a stratum of casein solution, or milk plasma, and this prevents the globules from uniting with each other.

Centrifugalization alters the relation between the surface tension of fat globules and milk plasma; the stratum of casein solution is wanting; the fat globules become coherent. Centrifugal cream must be *nearly proteid-free*, and the *fat globules are united* into a more or less coherent mass.

When this centrifugal cream is mixed in the laboratory with skim-milk and water and put into a feeding bottle, after standing a short time it separates into layers, which are as distinct as they were before mixing. Heat the food for feeding, shake it thoroughly, feed it to the baby, and if vomiting occurs, the vomited matters are first clear water, then butter-fat, and finally casein, or the skim-milk coagulated into a firm clot. This kind of vomiting is never seen except when a child is fed on a centrifugal-cream mixture. Machine-made cream should not be allowed in the feeding of infants. Its coherent fat globules are indigestible for the young infant, and it does not contain sufficient proteid for the development of the child. The skim-milk added to it is so beyond the digestive power of the child that the percentage of proteid cannot be increased to the requisite amount.

The second danger is the employment of heat.

For pointing out this danger we are indebted to another Philadelphian, Dr. Louis Starr.

Animals in which milk alone is a sufficient food die of inanition if the mineral substances are extracted, and the result is the same if these elements are added to the casein, fat, and milk-sugar, the organic combination being broken up.

The inorganic or saline constituents of milk to be assimilated must be in organic combination with the proteid.

Pasteurization destroys the organic combination between the proteids and the mineral elements of milk, and in the breaking up of the chemical union between these constituents is to be found the sole etiological factor of scurvy and rickets.

If sterilization is complete, and the supply of mineral constituents absolutely cut off, scurvy results; if the sterilization is less complete, and yet

the supply of inorganic and proteid constituents in organic combination greatly impaired, rickets ensue. Scurvy and rickets are one and the same condition; they arise from the same cause, differing only in the degree or intensity of that cause. Both conditions have but *one* cause—the insufficient supply of mineral elements and proteids in organic or chemical union, and according to the degree of cutting off, will one or the other result.

Deficiency of fat and the presence of starch in the food are not in any way related to the lesions of scurvy-rickets; insufficient supply of minerals and proteids in chemical union is the *sole* cause.

If a child does not have raw milk it will be found sooner or later that its tissues are suffering from salt-hunger—a condition which can only be relieved by the introduction into the system of *inorganic materials in organic combination with proteid substances.*

Within the body these salts are united to the proteids of the tissues and fluids. If the organic combination is destroyed the structure is dead. A food which does not contain inorganic elements and proteids in organic combination will not sustain life, and a food in which the destruction is partial only half sustains life. Much undefined ill-health in children has as its origin this cause, the nature of which is not even suspected by the medical profession. The Pasteurizer has no longer a place in the nursery

A third error which is placing milk feeding in danger is a circular which is issued for the enlightenment of the profession. This circular gives the following formulæ for the guidance of physicians in prescription-writing—*all of which are wrong:*

Fat.	Proteids.
2.00	0.75
2.50	1.00
3.00	1.00
3.50	1.00
3.50	1.50

For the best results in infant feeding the following relative proportions between fat and proteids will be found essential:

Fat.	Proteids.
2.00	0.25
3.00	0.50
3.50	0.75
4.00	1.00

An experience in the feeding of many hundred children from the Walker-Gordon Laboratory makes me feel confidently positive that these relative proportions must be adhered to if we are to avoid digestive and assimilative disturbances and secure satisfactory development of the child. The explanation of many of the failures in fine modifications is due to the fact

that the relative proportions between fat and proteids have not been correct. With proper relative proportions between fat and proteids we can easily feed a child on a mixture containing 4.00 fat and 1.00 proteid at the end of the first month, and on 4.00 fat and 2.00 proteid at the end of the fourth or early in the fifth month.

The proteid must be increased more gradually in summer, and a child of six or eight months will rarely digest more than 1 per cent. of proteid during the warm months.

The importance of the proteids on development is an essential factor in infant feeding. There will be found a close relationship between development and the percentage of proteids. The calf doubles its weight in one and one-half months and upon 4 per cent. of proteids. An infant doubles its weight in six months and upon 1 or 1½ per cent. of proteids. In other words, it takes the infant four times as long as the calf to double its weight, and on about one-fourth the amount of proteid.

Here comes in a wonderful provision of nature—namely, that cow's milk contains six times more of the inorganic constituents than human milk, and the bony framework of the calf develops proportionately. Cow's milk, when diluted four times, as we ordinarily prepare it, still contains a sufficient proportion of salts for the development of the infant.

A final error is that we are told that we should not add more than one-twentieth of lime-water to cow's milk when fed to infants. In my own experience this has led to unfortunate results. I have experimented a good deal with lime-water, and am absolutely confident that cow's milk should contain one-fourth lime-water when fed to infants. There may be exceptions. In winter, if the child becomes constipated, the lime-water should be diminished, but fully one-fourth should be used during the summer months and in early infancy.

We are in danger of too much chemistry and of too little individualization at the bedside.

Every statement which I have made regarding gravity *versus* centrifugal cream, the absolute necessity of raw milk, and the importance of lime-water have as their sole basis clinical results.

With gravity cream which has never been subjected to any degree of Pasteurization, with the proper relative proportions of fat and proteids, with one-fourth lime-water in early infancy and during the heated term, accurate scientific infant feeding is easy of attainment by any painstaking, practical physician who possesses the important faculty of individualization at the bedside.

Dr. Louis Starr: I feel that there is very little for me to say after Dr. Winters, as he has covered the ground very thoroughly. My views entirely coincide with his so far as separator or "laboratory milk" feeding is concerned. I advocate also a gradual increase in the albuminoid percentages as the infant advances in age. On the other hand, I cannot go quite so far

in the matter of attenuants, believing that these agents exert a mechanical action, tending to the formation of a finer and more readily digested curd than can be obtained by simple dilution with water, and that there are certain cases in which good results followed their employment; the best attenuant, in my opinion, is thin barley-water. While appropriate rules can be formulated to apply to the feeding of infants as a class, isolated cases constantly occur which have to be fed on their own basis. Speaking generally, I think the proper artificial food to employ must be composed of gravity cream, whole milk, milk-sugar, and water alkalinized; and that the percentage of albuminoids should, under favorable conditions in a healthy child, be gradually increased from 0.50 during the first week of life, until, at the age of ten months, it has been raised to 2.50 per cent, the quantity allowed for each feeding ranging from one to eight fluidounces.

Dr. J. P. Crozer Griffith: I feel entirely in accord with both of the points raised by Dr. Meigs; first, that the proteid percentage of mother's milk is low; second, that there should be no rule according to which the strength of the child's artificial mixture is increased in proportion to the age. There are, however, important exceptions to both rules which we must never forget. There are very great differences, which are well understood, existing between the proteids of cow's milk and mother's milk. It seems to me that Dr. Meigs' practice of calling all proteids *casein* gives an erroneous impression, inasmuch as we know that there is another proteid in mother's milk which is distinctly in excess of the casein, and which is much more easy of digestion. In fact, it is this preponderance of the casein as compared with other proteid matter in cow's milk which is one of our greatest difficulties in feeding a baby artificially.

Then, with regard to the increasing of the child's food. I have always been out of sympathy with the "rule-of-thumb" method which one sees in some medical writings, according to which a child at birth should receive a certain strength mixture, at three months another strength, at six months still another, and so on. This is entirely opposed to nature's way. The only rule which can guide us properly is the question of the child's comfort and weight. If a baby is evidently thriving on a low percentage mixture there is no occasion for increasing the proportions simply because the child is older. If, on the other hand, it does not gain and yet has good digestion, the proteids and probably the other ingredients also must be increased in strength. As a matter of fact, it is quite commonly necessary to raise a proteid percentage with increasing age; but I have seen the effort to do this simply because the child was older, occasion distinct indigestion. It is, as I have said, a question of weight and health which must guide us.

I dislike to disagree with Dr. Winters, and yet I must confess that I am not at all in accord with some of the statements which he has made. Take, for instance, his wholesale condemnation of centrifugated cream. One hears

the same objection raised from different quarters now and then, yet, although I have looked carefully into the matter, I have failed to see that the cry against it is supported by any evidence whatever, either clinical or experimental. I will cite you, for example, the vast experience of Dr. Roteh in Boston, and of many of the New York pediatrists with whom I am well acquainted, who never have any difficulty whatever in feeding children with it. My own experience, which I may claim is not small, does not uphold in any point the objection which Dr. Winters has made. Then if we stop a moment to think that practically all the cream which is bought in cities is centrifugated cream, we are forced to the conclusion that there can be no such great disadvantage in it as Dr. Winters has maintained. So much for the clinical side. From the scientific and experimental side this matter has been thoroughly tested. I may quote you the interesting experiments of White and Ladd, of Boston, who have shown that the separation of the fat to which Dr. Winters has referred is not due in any way to the use of centrifugated cream. These investigators tested mixtures with cream of this nature, with gravity cream, with whey, and so forth, and found that the breaking up of the emulsion would occur in any of the mixtures if the bottles were not kept cool and were shaken up badly in long transportation, as in a wagon. The statement that there is a difference in the emulsion of mixtures, depending upon whether gravity cream or centrifugated cream has been employed, is, I believe, largely an assumption which has never been confirmed either by experiment or by investigation with the microscope.

Next, with regard to the subject of sterilization. I do not favor either Pasteurizing or sterilizing when I can get milk upon which I can depend. But, Mr. President, we are surely in a desperate state if the use of heat produces all the harmful effects which have been ascribed to it to-night. It is not many years since practically every physician was recommending a thorough sterilization of all milk mixtures. Long before this those of us who were not fortunate enough to be fed upon mother's milk were given a cow's-milk mixture which had always been "scalded." This was and still is a common practice of the laity. Yet the race has seemed to survive pretty well in spite of the fact that the nourishing qualities of the food were practically destroyed, according to the statements which we have heard to-night.

With regard to the production of infantile scurvy by the heating of milk, I have had peculiar opportunities to study this matter most carefully, having been one of the members of the Committee of the Pediatric Society to review the cases obtained from American physicians. It is perfectly true that many cases of scurvy did develop upon the use of sterilized milk, yet the employment of commercial foods was found to be a very much more prominent factor, and there were cases not a few of which developed upon raw-milk mixtures and even in children who were fed solely at the breast.

It is, therefore, something more than the mere use of heat which is the causation of infantile scurvy.

After all, Mr. President, I am more and more impressed by the fact that this subject of the feeding of children is one upon which many different views may rightly be held. There is, I suppose, one ideal way of feeding children, but we have not learned it yet, and the excellent results which so many men obtain in methods very different show that we must carefully guard ourselves against statements which are too positive. It is our business to get as close to Nature's method as we can, but we cannot, in the present state of our knowledge, imitate her exactly, and we must never forget that no rule applies to every child. The individuality is a most important matter in the problem of infant feeding.

Dr. D. J. M. Miller: Dr. Meigs' father said a great many years ago that every child was a law unto itself, and he was the most successful physician who discovered the law for each child. This is the whole secret of infant feeding. No one mixture will agree with every infant, not even mother's milk.

To me it seems that a weak point in Dr. Meigs' paper is the use of an invariable mixture for every child of from one to six or nine months, without paying any attention to the natural variations in human milk or to the digestive capacity of the child. As to the strengthening of the food, I would like to ask why if he advises the use of his mixture until the age of six or nine months it should not be used longer? because certainly mothers nurse infants from nine to fourteen months on human milk alone without detriment. I notice that after the six months he advises it to be increased in strength. My own experience is like that of Dr. Westcott, that a baby after the third or fourth month will not thrive on a mixture like Dr. Meigs', containing only 1 per cent. of albuminoids, or only one-quarter of milk. The milk in the mixture must be at least one-third after the third or fourth month if we wish the infant to thrive. The experience of everyone is that as soon as the child can be given pure milk it should be done. I fancy if infants increase in weight after the fifth or sixth month on Dr. Meigs' mixture it is because of the large amount of sugar (7 per cent.) which it contains.

Dr. S. Solis Cohen: I should like to ask as to the experience of the speakers with the use of cream and whey mixtures. Sometimes, whether on account of the physical and chemical differences between the casein of human milk and the casein of cow's milk, or from other reasons, a child cannot be suited with the mixture of Meigs or any modification thereof involving the use of whole milk or skimmed milk. The albuminoid constituent of whey, as separated by rennet, seems then to be better adapted. I should also like to ask Dr. Meigs whether, in the course of his analyses, he observed anything tending to show any seasonal differences in the composition of human milk; in other words, whether Dr. Winters' clinical ex-

perience regarding the increase of proteid in winter is paralleled by any physiological change in the secretion of the mother at this season.

Dr. E. E. Graham: If, following the advice of Dr. Meigs, we feed children until the age of six or eight months on 1 per cent. of proteids; if, following the advice of others, we use nothing but gravity cream; if, following the advice of others, we use milk that is gradually increased in proteids from a few weeks up to twelve months, and if, following all these methods, the children gain continuously and progressively in weight, it looks as if it must be possible to feed children by a variety of theories and methods, and yet have these children constantly thrive. It must be, therefore, that in all these methods there is some one idea that neutralizes the differences in methods. The fact that all these gentlemen give milk that is carefully prepared at the farm, kept as far as possible germ free, given at regular intervals and in definite quantities, fed from clean bottles and nipples, must, I think, be the factors underlying these statements. Many physicians of large experience simply take milk diluted with water, and, if the milk has been properly cared for, get fairly good results. There is no question that if in a child born healthy the method is systematically carried out of taking human milk as represented by fat (4 per cent.), sugar (7 per cent), and proteid (1.5 per cent.), the child is given milk, gradually increasing in definite amounts of fat, sugar, and proteid, according as the child becomes older, until, at the age of thirteen months, most children can be fed on whole cow's milk, that the majority will pass through the period of childhood with little more digestive disturbance than the ordinary breast-fed infant. This is true whether they are fed on gravity cream or centrifugal cream. This applies only to children born healthy, living under the best hygienic conditions, and fed on gradually increasing percentages. I question whether a method of never giving infants more than 1 per cent. of proteids for the first six or eight months will show the same gain in weight, strength, and normal development as if the proteids were increased earlier.

Dr. Meigs, in closing the discussion, said: The question whether it is advisable to increase the strength of an infant's food at frequent intervals, as has been commonly advised, is, as I have said, one that can only be decided by the results of experience in trying the two methods, that of increasing the strength and that of using the same food, but increasing the quantity of it. It has surprised me very much, however, that the question has never excited the interest of which its importance makes it worthy.

In the course of the last twenty years I have seen many children fed according to the method that I have described thrive in the most satisfactory way. Infants so fed have not dwindled nor fallen into a state of malnutrition; on the contrary, they have thriven and developed in a natural way when given food of the same strength from birth until they were six or even nine months old. The heat of summer has not disturbed their health any more than it disturbs that of other healthy infants.

In regard to cream obtained by using the centrifugal machine, to Pasteurization, and to sterilization, my opinion is and has been from the beginning that they are occasionally necessary evils which may sometimes be used to get us out of difficulties. Under ordinary circumstances they should be avoided. In Philadelphia no one need complain that he cannot obtain good gravity cream. The milk supply is good, and it is only necessary to obtain good milk, and anyone can raise his own cream. It is necessary only to look to the fountain-head and see that the original source is good, and that pure and unspoiled milk only comes into the house when a young infant is to be fed.

Something has been said about the composition of casein. The truth is that we really know very little about it. The analysis of milk is as yet a very crude chemical process. We only know that milk consists of water, salts, fat, sugar, and something else. That something we have chosen to name casein or albuminoids or proteids. It is probably a compound substance, but what it really is none of us need pretend to understand. Milk analysis helps us to know how to make a food for babies, but the chemistry of casein is still in its infancy.

The question whether human milk changes with the changes of the seasons, and is different in summer from what it is in winter, is a hard one to answer. It is unlikely that there is any difference sufficient to be recognized by the present methods of analysis.

In answer to the question why I do not increase the food of infants until they are from six to nine months old, I can only say that in my method for their artificial feeding I have tried to imitate Nature, and that when I have followed my plan of increasing the quantity of food and have left the strength the same my efforts have generally been crowned with success. Anyone who says that children so fed fall into a state of malnutrition is mistaken. They do not.

I cannot agree with those who think that as good results can be obtained by the artificial feeding of young infants as would result if the same infants were nursed by their mothers. No system of artificial feeding has as yet been devised, or is likely ever to be devised, which will produce so large a number of healthy men and women as the nursing of infants by their own mothers.

AN ANALYSIS OF SIXTY-FIVE CASES OF GASTROPTOSIS.

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AND

ALBERT P. FRANCINE, A.M., M.D.[1]

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It is the purpose of the present contribution to place on record the study of a number of cases of gastroptosis, to analyze them, and to draw conclusions, which will be statistically accurate in the light of our present knowledge of the condition.

The view that gastroptosis is usually associated with downward displacement of the transverse colon and movability of one or both kidneys, and more rarely of the liver, had long obtained; but if we except the paper of Arneil, there has been wanting a collection of cases systematically studied upon which to base definite conclusions.

The records from which our material has been drawn, with a few exceptions of cases in our private practice, were taken from our service in the medical dispensary of the University Hospital during the past two years.

The position of the stomach and colon was determined after inflation with air, the kidneys examined for mobility, the recti muscles for separation, and the gastric contents after a test meal. Our investigations included as well the condition of the blood and urine.

The authors have been particularly impressed by the frequency of gastroptosis in women in general, and especially in that class which present themselves at our dispensaries. In 35 consecutive cases of women applying with stomach symptoms of the flatulent type, gastroptosis was found in all. We are of the opinion that gastroptosis

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and enteroptosis are much more common than is usually supposed, and that in a very large proportion of all women complaining of symptoms of gastric motor insufficiency the dominant factor is downward displacement of the pyloric end of the stomach.

The pathogenesis of splanchnoptosis has not been touched upon, for, unfortunately, the clinical study of these cases sheds little light on this much vexed question. As to the theory of a congenital or acquired diathesis predisposing to splanchnoptosis, there can be but little doubt that women of weak muscular organization are predisposed to it, and are more easily affected by exciting causes which have little or no effect upon other individuals. The most common of these exciting causes is probably something that tends to constrict the thorax or upper abdomen or to increase the volume of the abdominal cavity. Perhaps the truest thing that can be said in this connection is that different causes are potent in different cases, and it is not wise or necessary to try to formulate a theory that will apply in every instance.

Our series included all types of individuals; not only women in middle life who have borne children and who show a considerable degree of diastasis of the recti muscles, but also males and young nulliparous women whose abdominal walls were firm and where normal approximation of the recti existed.

Position of the Stomach. The stomach was first emptied by lavage and then inflated with air through the tube. As the organ is distended it rises to the abdominal wall, and its outline can usually be plainly seen. By percussion and auscultation, however, its position and size are accurately determined and noted on a suitable diagram. In order to convey to the reader an approximate idea of the size and position of the stomach the authors have divided the distance between the umbilicus and ensiform and the umbilicus and top of the symphysis each into four equal divisions. The two principal areas thus subdivided are usually equal, and in persons of average stature are about five to six inches or twelve to fifteen centimetres in extent. While at the first glance this may appear somewhat confusing, practically it is not so, as it will be found that nearly all displaced stomachs will fall into one or another of these positions without in any sense coercing natural boundaries to arbitrary lines. It may be said of the umbilicus, as of the nipple, that it is not a fixed point, but for practical purposes it is a fairly accurate landmark.

Following this plan, it will be found that the upper and lower curvatures or borders of the stomach may in the vast majority of cases be spoken of as falling in the quarter, mid-, or three-quarter line or position above or below the umbilicus; and it may be stated that in the prevailing type of gastroptosis the umbilicus is found to be the centre of a portion of a circle formed by the dilatation of the pyloric end with the upper and lower curvatures midway between the ensiform and symphysis, respectively. The cardiac end remains in its normal position slightly above and behind the apex of the heart, and the general curve of the ptosed viscus has not inaptly been described by Kelling as resembling a fish-hook.

In a recent paper by one of us (Dr. Steele) the statement is made that in his list of cases there were several that showed displacement of the cardiac end, giving rise to the descensus in toto, or hunting-horn shape, described by Riegel. Further examination of these cases has convinced us that this was an error. While theoretically such displacement is possible, no instance of it appears in our list, which includes Dr. Steele's cases, and we feel that its occurrence must be very rare. The cases in which the error was made presented an extreme degree of pyloric dilatation in stomachs originally small, but careful examination has convinced us that the cardiac end was in its normal position. In our series of 65 cases the upper and lower curvatures in 24 were midway between the ensiform and umbilicus and symphysis and umbilicus, respectively; in 9 the upper curvature was in the quarter position above, with the lower curvature midway below; in 9 the upper curvature was in the three-quarter position above, with the lower curvature midway below; in 7 the upper curvature was midway, the lower curvature in the quarter position below; in 5 the upper curvature occupied the three-quarter position above, the lower curvature the one-quarter position below; in 3 the upper curvature was in the one-quarter position above, with the lower curvature in the three-quarter position below; in 2 the upper curvature was midway, with the lower curvature in the three-quarter position below; in 2 cases the upper curvature was at the ensiform and the lower curvature was midway between the umbilicus and symphysis; in 2 cases the upper curvature was at the umbilicus and the lower midway; in 1 case the boundaries were at the ensiform and midway, and in 1 the boundaries were in the quarter position on either side of the umbilicus.

Dilatation. Some dilatation of the pylorie end of the stomach was present in every one of our series. The average degree of enlargement is such that the outline of the pylorie extremity forms three-fourths of a circle of which the centre is the umbilicus. It is conceivable that there may be a stage very early in the course of primary gastroptosis when pyloric dilatation is absent, but by the time the patient seeks medical advice such a condition is invariably present. This form of dilatation may readily be accounted for by the loss of muscular tone, stagnation and fermentation of the retained contents, and consequent distention. Another factor in its causation is the increased effort necessary on the part of the weakened muscle to force the food up and through the pylorus and the prolonged first and second portion of the duodenum, so that it may enter the third portion, and thus on into the small intestine.

When the cardiac end of the stomach is enlarged as well we have considered the condition to be one of general gastrectasis. Our investigations have convinced us that in a majority of cases general dilatation does not long exist without downward displacement of the pylorus, due to the dragging of the enlarged and overweighted pylorie end upon its supporting ligaments.

The proper etiological relation of pylorie and general dilatation is probably correctly explained by saying that the pylorie dilatation is secondary to a primary gastroptosis, while in general dilatation with gastroptosis the former is the primary factor.

The comparison of the forms of dilatation occurring in the two sexes is of interest, since it shows that general dilatation in combination with downward displacement of the pylorus is more common in men, implying that gastroptosis in the male sex is due to primary dilatation in about half the cases in which downward displacement of the pylorus exists.

Gastroptosis with pyloric dilatation only:	
Women	48
Men	7
Gastroptosis with general dilatation:	
Women	2
Men	8

Transverse Colon and Flexures. The question of the position of the transverse colon, and more especially of the colonic flexures, is one of considerable difficulty.

We have examined the colon by inflation with air in 32 cases of our series. While we regard air inflation through the rectum as the best of the different methods so far devised, it is only in certain cases that a very definite idea can be obtained of the position of the large intestines. Unless the abdominal wall is thick or very rigid the sigmoid flexure, the transverse colon, and the cæcum may be seen and palpated when the bowel is inflated with air. In each instance percussion has been employed to confirm the results of inspection and palpation.

From the study of these cases the authors are of the opinion that in gastroptosis the transverse colon always shares in the downward displacement, and when filled with air occupies a position immediately below and in contact with the greater curvature.

The more difficult question is in regard to the hepatic and splenic flexures. The theory of Virchow and Glenard that the hepatic flexure descends first, dragging after it the right half of the transverse colon, while the splenic flexure remains in place, is as difficult to substantiate as to disprove. The hepatic flexure lies more deeply than the transverse colon or the cæcum, and while its upper limit is apparently fairly well defined by the upper limit of the tympany elicited in the right flank after inflation, we cannot but feel that there is considerable room for error.

The splenic flexure lies behind the greater curvature and cardiac end of the stomach and eludes satisfactory demonstration.

In our series we usually found some downward displacement of the hepatic flexure, while the splenic flexure was lost on the opposite side of the abdomen, usually three to five centimetres below the umbilicus, where it passed behind the greater curvature. In several cases the hepatic flexure was plainly as high as the costal margin.

We believe that both the bowel and stomach when inflated tend to assume a higher position than when empty and relaxed. Thus in Cases 25 and 56, where the position of the viscera was determined at operation, the transverse colon lay fully a hand's breadth below the greater curvature, while the flexures were well above the umbilicus, although in all of our cases the colon, when inflated, followed closely the lower border of the stomach. It may well be that in many of such displacements the undistended transverse colon sinks much lower than the stomach, but when filled with air it rises up-

ward as well as forward to the abdominal wall and comes in contact with the greater curvature.

Kidneys, Liver, and Spleen. In our examination of the kidneys we have employed the bimanual method, in which the patient lies upon the back with the thighs flexed upon the abdomen and with the abdominal wall as relaxed as possible. One hand is placed over the lumbar region and the other is passed down as far as possible under the margin of the ribs. Palpation is made during both forced respiration and when the abdomen is in repose. In describing the degree of displacement we have adopted the following nomenclature: When the lower edge can be felt upon deep palpation the kidney is said to be movable in the I. degree. The term II. degree is used when, during forced respiration, the finger-tips can be slipped above the upper pole of the organ, but it cannot be brought below the level of the navel. When the kidney can be pushed freely about in its own half of the abdomen, or even beyond the median line the term III. degree is applied. In 26 out of 57 cases, or 45.6 per cent., the right kidney could be palpated. In 14 of these it was barely palpable, in 10 it was movable in the II. degree, and in 4 cases movable in the III. degree. Both kidneys were movable in 2 cases. Ptosis of the liver occurred three times and that of the spleen once.

Total cases of gastroptosis examined for abdominal movability and ptosis of kidneys, liver, and spleen		57	
Right kidney alone movable:			
Females,	I. degree	13	
	II. degree	9	
	III. degree	4	
Males,	I. degree	1	
	II. degree	1	
	Total	28	or 45.6 per cent.
Both kidneys movable:			
Females, both	I. degree	1	
	both III. degree	1	
	Total	2	or 3.5 per cent.
Total cases of gastroptosis with ptosis of kidneys		28	or 49.3 per cent.
Total cases of gastroptosis with ptosis of liver		3	or 5.2 per cent.
Total cases of gastroptosis with ptosis of spleen		1	or 2 per cent.

Case 54.—Operation showed a much enlarged liver, which was displaced downward and was abnormally movable. Gastroptosis and movable right kidney.

Case 55.—There was great movability and displacement of both kidneys (III. degree), liver, and spleen.

Case 56.—Operation showed that the liver was unduly movable and displaced downward.

Case 60.—Both kidneys were palpable for about half their length in deep respiration.

Thus in 2 of our cases operation showed that the liver was unduly movable and sagging downward. As this is 40 per cent. of the cases operated upon, the idea strongly suggests itself that ptosis of the liver may elude our methods of physical examination and be more frequent than has been supposed.

Neurasthenia. This associated taint, which has played so conspicuous a rôle as to give rise to the theory of Charcot and Bouvert that it was the cause of gastroptosis, was not very infrequent in our series. The tendency of later observers seems to be to place very little weight upon neurasthenia as the primary cause of abdominal ptoses. In 48 cases it was present in 22, or 45.8 per cent. The difficulty in obtaining accurate data as to the presence or absence of neurasthenia in dispensary practice is considerable. While it may be present in the same degree in the class of patients who present themselves in our dispensaries as in those seen in private practice, it is certain that its manifestations are not so pronounced as in those more well-to-do and highly strung. It should also be borne in mind that in a brief acquaintance with a walking patient it is not always easy to make a diagnosis of neurasthenia.

In cases of gastroptosis suffering with various functional disorders of the nervous system a distinction must be made between these symptoms and true neurasthenia. The fact that gastroptosis does occur in a large proportion of cases without neurasthenia disproves the theory that the two are interdependent. It is much more likely that when they coexist they are merely concurrent manifestations of some constitutional weakness, be it congenital or acquired.

Analysis of the Gastric Contents. The condition of the gastric contents after the ingestion of an Ewald test-meal was most frequently one of hypoacidity. A certain proportion were approximately normal, and hyperacidity appears to be uncommon. Free hydrochloric

acid was absent in 13 cases of 41 examined, or 31 per cent., and in 17 cases the free HCl was 10 or under. Thus in 73 per cent. the amount of free HCl was subnormal.

In 7 cases the acid was approximately normal in amount. All of these were well-marked examples of the condition and of considerable duration.

The figures given are in terms of decinormal soda hydroxide solution.

Four cases showed hyperacidity. In case 59, a young woman who had suffered with chlorosis and was quite neurasthenic, the total acidity was 80 and the free HCl 35. The stomach was subvertical in position, with dilatation of the pyloric end alone.

Cases 22, 35, and 53 showed a total acidity of from 65 to 80, with free HCl 30 to 40.

They were all examples of general dilatation, and if our supposition is correct that in such instances the gastroptosis is secondary, it is perhaps not fair to base a judgment as to the frequency of hyperchloridia in primary gastroptosis upon them.

Free HCl absent	13	Average total acidity .	16
Free HCl 10 and under . . .	17	Average total acidity .	52
Free HCl 25 and under . . .	7	Average total acidity .	48
Free HCl above 25 . . .	4	Average total acidity .	70
Free HCl present but not estimated	2		

Symptoms. In those cases in which the dilatation affected the pyloric extremity alone the subjective symptoms were those of motor insufficiency of a mild grade. Evidences of fermentation, as manifested by gaseous eructation coming on an hour or so after meals, were observed in every case. Some degree of auto-intoxication was almost as constantly present. Attacks of frontal headache accompanied by nausea followed fatigue or indiscretions in diet, and which were relieved by treatment directed to the stomach, occurred in 20 per cent. Pain in the epigastrium or upper abdomen was complained of in 52 per cent. Its character varied, but was most often described as dragging, and was most intense an hour or so after meals. Pain in the lumbar region was present in 25 per cent., vomiting in 20 per cent., and nausea in 12 per cent. Constipation was the rule, and was decided in character in 60 per cent. A small proportion of the rest suffered from alternating diarrhœa and con-

stipation, and in one or two diarrhœa alone occurred, which was relieved by lavage and by medicinal measures directed to control fermentation.

In the cases of general dilatation with gastroptosis the signs of impairment of motor power were much more pronounced, and it was here that the only instances of decided retention occurred. Two of the cases of vomiting were in men, with marked general dilatation. Evidences of auto-intoxication were much more intense in this class of patients.

It seemed to us that displacement of the stomach was the dominant factor in the production of subjective symptoms. Signs of intestinal disturbance were not intense in any of our cases. The constipation and diarrhœa were moderate and easily controlled. With the exception of those cases in which the kidney was floating the dislocation and movability of that organ did not give physical discomfort.

Floating Tenth Rib. This stigma, described by Stiller, was noted in only two of our series.

The Splashing Sound. Our experience with this sign, if properly used and elicited, is that it is of value as indicating a decrease in power of the stomach muscle when obtained during the period of digestion, and of motor insufficiency when obtained at a period when the stomach should have emptied itself into the duodenum. In studying the relations of the splashing sound to atony the patient should be under observation for a longer time than a dispensary service allows. Consequently we have not been able to obtain data of any value in this connection.

The Urine. The urine was negative so far as routine examination is concerned. The average specific gravity was not above normal, arguing against any considerable degree of concentration as seen in severe cases of gastric motor insufficiency.

Separation of the Recti Abdominalis. This important sign, described by Webster, was noted in 17 of 46 cases examined—*i. e.*, in 37 per cent. The amount of separation varied considerably, in some instances being only sufficient to admit the finger-tips, in others the width of three or even four fingers. It was not present in 10 males, and was much more common in women who had borne children and whose abdomens were pendulous or relaxed.

The Blood. Meinert, in his original paper, held that chlorosis was the cause of gastroptosis, but his views were refuted by Kelling, who showed that the two conditions had no direct etiological connection. Our series bears out this conclusion, for only one of our cases suffered with chlorosis, while in the greater portion of the remaining the blood was normal, and the rest showed but a slight secondary anæmia. The high-color index in the following table speaks for itself in excluding chlorosis:

Hæmoglobin, 85 and over . .	21	Average color index .	0.95
Hæmoglobin, 60 to 84 per cent. .	20	Average color index .	0.9
Hæmoglobin, 35 per cent. . .	1	Color index	0.5

A discussion of the methods of treatment would be out of place in a paper of this character. However, the experience obtained in the observation of our cases has impressed us with several facts that seem worthy of mention.

1. Relief from the symptoms of gastric motor insufficiency in gastroptosis can only be obtained by mechanical support. This statement applies as well to cases of general as to those of pyloric dilatation.

2. Systematic lavage is not indicated when mechanical support is employed, provided the gastroptosis is not complicated by advanced atony and retention, or by great alteration in the functions of the gastric mucous membrane. We have found lavage of advantage: (*a*) In cases of extreme atony and general dilatation with much retention; (*b*) in cases in which, without great dilatation, there is an excessive secretion of mucus.

Five of our cases have been operated upon. The results will be reported in detail by the gentlemen who performed the operations.

Condition, Age, and Sex. In our series there were 50 women (70 per cent.) and 15 men (30 per cent.). Twenty-seven of the women were married, and of these 18.66 per cent. had borne children. It will be seen that 46.5 per cent. of the women were nulliparous.

Very few of our dispensary cases are under twenty years of age. Consequently we have been unable to determine whether gastroptosis is frequent in childhood, as claimed by Meinert. A great majority of our series came under observation while in the third, fourth, and fifth decade.

TABLE OF AGES BY DECADES.

Under 20	1
20 to 30	24
31 to 40	16
41 to 50	18
51 to 60	2
61 to 70	1
Over 70	1

The youngest patient was a girl of eighteen years, the oldest a man of seventy-one years.

Conclusions. 1. Gastroptosis is much more common than might be inferred from the meagre references made to it in a majority of the text-books upon general medicine. In women showing symptoms of gastric motor insufficiency its presence is almost constant, and it is probably the most important factor in the causation of such symptoms. It is much less frequent in men.

2. The occurrence of gastroptosis is not confined to any particular age or class of individuals. There are no causative factors common to all cases, and no explanation of its etiology heretofore given is broad enough to be wholly satisfactory, if we except the theory of congenital predisposition, which is entirely hypothetical.

3. The position assumed by the stomach in all of our cases was vertical or subvertical. Total descent was not observed, and probably is extremely rare.

Some dilatation of the pyloric extremity was always present. When this dilatation affects the pyloric end alone it may perhaps safely be assumed that the dilatation is secondary to the descent of the pylorus. In general dilatation and gastroptosis it is probable that the displacement is secondary to the dilatation.

The data in regard to the position of the stomach were obtained in every case by inflation with air through the stomach-tube. The colon was inflated through the rectum.

4. The transverse colon invariably shared in the displacement, assumed the M or Y shape, and when inflated by air was in close contact with the greater curvature of the stomach. The hepatic flexure may not be displaced or may sink to the level of the umbilicus. The splenic flexure lies behind the stomach and eludes demonstration.

5. The right kidney was movable in practically half of the cases (49 per cent.). The degree of movability was slight in 53 per cent.,

decided in 34 per cent., and extreme in 13 per cent. The left kidney rarely showed abnormal movability, and the spleen in but one case. The fact that the liver was observed to be unduly movable and sagging downward in two of five cases operated upon suggests that ptosis of the organ may elude our methods of physical examination and be more frequent than is usually supposed.

6. There is no condition of the gastric contents peculiar to gastroptosis. Absence or diminution of the free HCl is the rule. In a few cases the amount was normal. Hyperacidity was rare, and usually occurred in cases where general dilatation existed and when there was a strong neurotic taint.

7. There were no characteristic changes in the blood or urine.

8. The subjective symptoms were those of gastric motor insufficiency, and were of a mild grade in cases of primary ptosis, but more severe where general dilatation existed. Pain was present in the upper abdominal region in about half, and in the lumbar region in a quarter, of our cases. Constipation is the rule, though diarrhœa may occur.

9. The same causes that produce neurasthenia appear to favor the development of ptosis of the abdominal viscera. When the two conditions coexist in the same individual they probably react upon each other deleteriously, but clinical evidence tends to contradict the theory, previously widespread, that they have a direct causative relation.

Historical Sketch. Gastroptosis was first described as a clinical entity by Frantz Glenard, of Paris, in 1885. He attributed the symptom complex, so well recognized under the term of "nervous dyspepsia," to the underlying condition of gastroptosis, and described the transverse colon as being usually displaced downward and the right kidney as movable. In common with Virchow, who had written upon changes in the position of the stomach and intestines as early as 1853, Glenard considered the displacement to be the result of adhesions between the viscera exerting mutual traction. He thought the adhesions were usually overlooked clinically, and were the result of localized areas of peritonitis. While in certain instances such adhesions may exist, they are no longer considered an important factor in the etiology of splanchnoptosis.

Glenard considered inflation of the stomach and colon with air or water valuable from the point of view of experimental demonstration,

but superfluous in routine work. He relied largely on signs which we have now come to value little, such as epigastric pulsation, elapotement, or the splashing sound of the stomach, the so-called belt sign. He thought that the hepatic flexure was the first to fall, and that this dragged down the transverse colon, and that after the descent of the transverse colon the stomach followed from traction upon the gastrocolic ligament. While at first it might be supposed that the hepatic flexure was the first portion of the gut to descend, and in certain cases this may be so, yet that this is not true in all cases has been shown by Niesel, who in 100 autopsies found that the hepatic flexure was in its normal condition in 34 per cent. Landau, in his admirable contribution on "Floating Kidney," describes a descent of both the hepatic and splenic flexures of the colon as a constant accompaniment of nephroptosis. His data were all obtained from post-mortem investigations, and, as we have endeavored to show, it is probable that reliable information as to the condition of the flexures of the colon cannot be obtained in any other manner.

In France, Glenard's paper was followed by contributions upon the same subject by Cuilleret, Fercol, Chiron, Pourcelout, Trastour, and others.

In Germany both Virchow and Chalpowski had written upon displacement of the abdominal viscera prior to Glenard, but Ewald was the first German clinician to study gastroptosis and enteroptosis systematically. In 1891, in a masterly article, he pointed out the fallacy of relying upon the belt sign, or elapotement, as signs of gastroptosis, and insisted upon inflation of the stomach and colon with air as the best method of diagnosis. Stiller has recently described the floating tenth rib as a valuable sign and a quite constant stigma of floating kidney and gastroptosis. Meinert, in 1894, from the study of a number of cases of chlorosis, came to the conclusion that gastroptosis was the important factor in the etiology of the former condition. His views, however, were shown by Kelling in the following year not to be well founded, and our series of cases bears this out conclusively. Among many in Germany who have contributed to the literature of this subject may be mentioned Reigel, Leube, Boas, Fleiner, Israel, and Ott.

In America the study of this condition has added the systematic inflation of the stomach and colon with air, and suggestions for operative treatment. Pepper and Stengel, in 1900, fully insisted

upon the inflation of the stomach, and the present writers have extended its use to the colon. They venture to think, however, that from its apparent difficulties, and inasmuch as the position of the colon will be found to bear a fairly constant relation to the lower curvature of the stomach, the necessity for the routine application of the latter procedure will disappear.

J. Clarence Webster has recently called attention to the separation of the recti abdominalis as a sign of importance in gastroptosis. Einhorn, in 1889, under the name of gastrodiaphane, described an electrical apparatus to be passed into the stomach for purposes of transillumination, and Hemmeter has extended its application to the colon. In Philadelphia, Stengel and Beyea have suggested operative measures for the relief of gastroptosis, and Bleeher, in Prague, has reported four cases from Bier's clinic in which the operation as first performed by Beyea, in 1898, was carried out with good results. Treves, Webster, Ingalls, and others report successful operations for the relief of this condition. In addition to the above clinicians, Van Valsah and Nesbit, Rose, Lincoln, Musser, Edsall, Steele, and others have studied and contributed to the literature of this subject.

TROPICAL ABSCESS OF THE LIVER, WITH REPORT OF A CASE.

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[Read May 7, 1902.]

THE patient, Max G., aged thirty years, a native of Russia, applied at Medical Clinic No. 1, Philadelphia Polyclinic, on September 2, 1901, and in Dr. Cohen's absence from the city was seen by Dr. Truman Augé, chief of clinic, from whose excellent notes much of the history that follows is taken.

History. Three years ago, while in South Africa, being shut up in Kimberly with insufficient food and bad water, the patient suffered an attack of illness characterized by looseness of the bowels, the stools occurring ten to fifteen times a day, being dark in color and streaked with blood or containing bright blood. The stools were not accompanied with pain. The patient's appetite remained good. The stools had not a particularly offensive odor. No record of fever could be obtained. His feet were swollen, and he lost flesh and strength. The intestinal discharges became at times apparently normal, but after a brief period would return to their former condition. Two months after the onset the illness was diagnosticated as dysentery by the physician then consulted. The patient suffered intermittently for about eighteen months, when he determined to leave South Africa. His condition improved as soon as he got on board ship. During the voyage he gained flesh and felt better, but did not gain in strength. The voyage lasted twenty-eight days. Improvement continued for about eight months after landing in this country. The swelling of the feet disappeared entirely two months after leaving ship. About a year before his visit to the Polyclinic the bloody stools recurred, and had, according to the

patient's statement, continued intermittently ever since. There had not been chill or fever. The patient attended the dispensary irregularly for about a month, during which time the condition of the bowels improved. Dr. Cohen saw him on October 7, 1901.

Physical Examination (October 7, 1901). The heart was displaced to the left and upward, the apex-beat being felt in the fourth interspace and nipple line, but was otherwise normal. The sounds were weak; the pulse feeble but rhythmical, and not very rapid. The exact rate was not recorded. No pulmonary lesion was found. Both lungs were compressed, the right more so than the left. There was no effusion. On examination of the abdomen a mass was found occupying the right hypochondriacal and umbilical regions. Its percussion note was continuous with the normal liver dulness, which was also much enlarged upward, beginning in the fourth interspace at the right border of the sternum, but in the mid-axillary line at the upper border of the fifth rib. The mass had a mean projection of one and a half inches. It was tense, hard, and smooth; the lower edge was rounded, and could be distinctly traced at a mean distance of about four finger-breadths below the ribs; the left border running from the apex of the heart to about one inch above the umbilicus, the margin then dropping to the umbilicus, and thence running to the right mid-axillary line at the same level on a curved line, with convexity outward. Posteriorly the dulness extended on the right of the spine from the ninth rib to below the costal border, reaching about three inches to the left side of the spine and tapering to a point. The splenic dulness began at the seventh rib in the paramammillary line, at the eighth rib in the posterior axillary line, and extended transversely from this point to the mid-scapular line, merging below with the dulness of the liver; these conditions probably indicating an enlargement of the organ as well as a displacement backward and upward. At the most prominent part of the hepatic mass, about an inch below the tip of the xiphoid cartilage, there was a circular area about as large as a silver dollar, having an elastic "cystic" resistance. There was no pain or tenderness over the enlarged liver or over the abdomen and thorax at any point. Neither the thoracic nor the abdominal wall was reddened. There was no œdema. The abdomen outside of the dull area was tympanitic. No distinct hydatid tremor or fremitus could be found, but there was an indistinct and inconstant crepitus which could be heard over the tumor, and which it was thought might be due to daughter cysts rubbing against one another. The superficial veins of the abdomen were slightly distended, and except in the right groin no lymphatic enlargement could be detected. A number of white scars were seen over the right hypochondrium and right chest, which the patient attributed to "winter-pox" occurring in his childhood in Russia. The patient denied any venereal disease. The enlargement of the abdomen was first noticed aboard ship, shortly after leaving Africa, and it seemed to increase before an attack of dysentery, and

diminish afterward. It had given him no inconvenience, nor would he have thought it worth mentioning if examination had not been made. The patient was not jaundiced, and not apparently anæmic. The tongue was but slightly coated. The blood, feces, and urine were examined by Dr. Coates, of the Polyclinic Laboratory, with the following findings:

Blood. Hæmoglobin, 80 per cent.; red blood cells, 4,570,000; leucocytes, 13,400; no abnormal bodies.

Feces. Bacilli coli communis; staphylococci; no amœbæ.

Urine. Amorphous urates; uric acid crystals; a few granular casts. Reaction strongly acid. No parasitic ova; no sugar; no albumin. Sulphates normal. Chlorides, 1 per cent.; urea, 3.2 per cent.; indican, small amount. No leucin or tyrosin; bile-pigment and biliary acids absent.

Diagnosis apparently lay between abscess of the liver of amœbic origin and hydatid cyst. The long duration of the tumor, its enormous size, and the absence of the usual symptoms of abscess were strongly in favor of hydatid cyst; the history of the dysentery, however, which originated in South Africa, caused us to consider strongly the question of amœbic abscess. The patient had suffered no pain excepting recently, and that of only a transient kind. There was no tenderness and no history of a previous tenderness. The elevation of the temperature was insignificant, and there was no history of marked fever or rigor at any time. The patient's general health was apparently good. The blood showed no marked leucocytosis. The amœbæ were not found after repeated examinations. There was no œdema over the liver either in the thoracic or abdominal wall. The character of the enlargement itself, its smoothness, the absence of tenderness, and a sense of fluctuation at its most prominent part also tended to confirm the idea of hydatid disease. Strongly in favor of abscess was the fact that the patient reported that after he had been informed by Dr. Cohen that surgical consultation would be necessary and possibly operation, he sought other advice, and that an exploring needle had been introduced into the swelling and that pus had been withdrawn. As this exploration had been made by a competeut physician we were obliged to attach to it considerable importance. At the same time, however, it must be remembered that fluid similar to that described by the patient might have been obtained from a suppurating hydatid cyst.

Operation was performed on November 6, 1901. As the tumor involved the anterior portion of the liver more extensively than the posterior it was determined to approach it through an incision just below the very much elevated costal border. A straight incision, three inches in length, was made over the most prominent part of the tumor. The peritoneum was not adherent, and there was no fluid in the abdominal cavity. The liver appeared somewhat darker than normal, extended nearly down to the right iliac fossa, and on its upper surface, which was moderately adherent to the diaphragm, gave a sense of distinct fluctuation. The general abdominal

cavity was thoroughly walled off from the point of puncture by large gauze pads. An aspirating needle was introduced into the liver, and through it flowed a thick brown pus. After the withdrawal of the aspirating needle the abscess cavity was freely opened by means of the Paquelin cautery. An enormous quantity of pus of the character above mentioned escaped through a glass drainage-tube which was introduced, but unfortunately the exact amount could not be ascertained because of the necessity of constant irrigation in order to prevent infection of the general peritoneal cavity and in order to thoroughly cleanse the abscess cavity. Certainly, several quarts of pus were removed. When the abscess cavity had been emptied the liver had so contracted that the opening made by the cautery was no longer opposite the abdominal incision, therefore a transverse incision was made along the costal border at right angles to the primary incision, a rubber drainage-tube and the packing being brought out of the lower end of this second incision. The patient reacted well from the operation. There is very little to report in the subsequent clinical history of the case. The patient suffered from some cough for a few days after operation, but otherwise made a very satisfactory recovery without complication. The drainage was at first profuse, but gradually diminished until about the middle of February, when it entirely ceased. Two points are worthy of note in the post-operative history: a very great increase in weight and a rapid contraction of the liver. An examination of the pus showed it to be sterile, and no amœbæ were found. Repeated examinations of the pus and detritus failed to demonstrate the presence of amœbæ.

Pathology. The frequency of liver abscess among our soldiers in the Philippines and among the British in South Africa has brought this question into considerable prominence in English literature. Robinson (*Journal of the American Medical Association*, May 12, 1900), says that in ninety-six autopsies done on soldiers dying from dysentery in the Philippines, liver abscess was found twelve times. Of course, pyæmia, traumatism, gallstones, and round worms frequently produce abscess of the liver, but probably the most frequent cause of single abscess is some form of dysentery. And further, the amœbic type is that which most often produces the condition. The amœbæ can often be demonstrated in the scrapings from the abscess wall when not to be found in the pus itself. It is to be regretted that in this case the wall of the abscess was not scraped with this object in view. Although we look upon multiple abscess of the liver as usually of pyæmic origin, yet the fact that about one-half of the liver abscesses occurring in tropical countries are

multiple would incline one to the view that the amœba is more frequently than we suppose the cause of this variety. Giordano, of Venice, in discussing this question before the Intercolonial Congress of Medicine, 1900 (*British Medical Journal*, October 13, 1900), said that alcoholism was often a predisposing cause of liver abscess, and in this view Adamidi agreed, though he asserted that the determining cause was an ascending angiocholitis of intestinal origin. This statement regarding the predisposing tendency of alcohol may explain, to some extent at least, the greater frequency of liver abscess among American soldiers in the tropics than among the more temperate natives. The abscess may be found at any point in the liver, but is most frequently situated in the right lobe, either near the anterior or the posterior border. If left to itself the abscess will, in most instances, rupture into the pleura or lung, although rupture into the peritoneum or on the surface is not rare. Spontaneous cure often results from rupture into the lung, as in the case recently reported before the Philadelphia County Medical Society by Dr. Boston: but, of course, to wait for such an occurrence would be extremely unwise and comparable to the fallacy of waiting for adhesions to form after making a diagnosis of appendicitis. It is needless to say that unless immediate operation is done intraperitoneal rupture is invariably fatal. The mortality of liver abscess without operation is between 90 and 95 per cent., those cases recovering usually doing so after rupture into the lung.

Treatment. The treatment, when once a diagnosis is made, is entirely surgical, and consists in thorough opening and thorough drainage. The aspirating needle may be looked upon in some instances as a safe diagnostic means when proper aseptic precautions are taken, but it is by no means a sure measure, and should only be employed when the surgeon is prepared to proceed at once to operate in case pus is found. This is particularly true when the abscess is situated anteriorly, for here the infected needle must traverse the peritoneal cavity, which is, in most instances, not shut off by adhesions. It is quite true that in many cases the needle is used, pus is found, immediate operation is not done, and the peritoneum is not infected—in fact, it was true in the case here reported; but the practice is a bad one, exposing the patient to considerable

unnecessary risk. Anyone having experience with the exploring needle needs not to be told of its inaccuracies or how very misleading its evidence oftentimes is. The proper time for the employment of this instrument arrives when the liver has been exposed by a free incision, and the surrounding cavity, pleural or peritoneal, properly protected with gauze. At this stage the needle not only locates the abscess, but indicates to the operator the best point at which to drain. There are two recognized methods of operating in this condition, and between them foreign surgeons particularly are much divided. The first operation is that of immediate drainage, while the second consists in exposing the liver, allowing it to become adherent to the abdominal wall, and then opening it twenty-four or forty-eight hours later. In the hands of an experienced surgeon the former operation would certainly seem to be the most satisfactory procedure. Under doubtful aseptic circumstances an inexperienced operator would probably be wise to follow the second method. Smits (*New York Medical Journal*, February 9, 1901) reports from the island of Batavia the most gratifying results from the employment of the two-stage operation—sixteen recoveries out of nineteen operations. It is doubtful, however, that these good results were altogether due to the two-stage operation. After the location of the pus by the needle we believe that there is no better instrument for incising the liver tissue over the abscess than the Paquelin cautery. Curettement of the abscess wall is a measure strongly advocated by Fontan, but its employment in abscesses of short duration would seem questionable; and, in fact, the present case would tend to show that it is not an essential part of the treatment even in abscesses of long duration. In the introduction of the drainage-tube care must be taken that the end of the tube does not rest on the abscess wall, else such pressure might produce necrosis and perforation. One point in the technique of this operation which is frequently dwelt upon is the stitching of the liver to the abdominal wall. This procedure does not seem necessary if the precaution is taken to carefully surround the tube with gauze, and might possibly interfere with the subsequent contraction of the abscess cavity. It was not done in the present case nor in another recently seen in which an equally good result was obtained.

DISCUSSION.

Dr. J. Alison Scott: In many of these cases of liver abscess an acute hemorrhagic pleurisy is a very important symptom. In the past year I have seen three cases of liver abscess. Two of them apparently had been latent for many months. There was no history in two of these of previous intestinal disease, certainly not of dysentery. The men seemed to have wasted and to have had irregular temperature. The third case was characterized by acute symptoms. The initial symptoms in two—one acute, one chronic—were referable to the pleura on the right side. The one man came into the hospital with the most intense orthopnœa. The chest was flat, and upon aspiration a large quantity of bloody serum was removed from the pleural cavity. In two weeks' time effusion, as it was then termed, was again removed. By this time the liver attracted attention. It was very large and somewhat tender. Careful examination of the material then removed showed liver cells, bile, and blood pigment, but no amœbæ. Subsequent developments confirmed a diagnosis of a large abscess with fistula into the pleural cavity. The second case was somewhat similar, though the pulmonary symptoms were more bilateral. A third case, which was acute, came on apparently suddenly as an acute pleurisy. A man in perfect health was suddenly attacked with acute pain in the right side. On admission to the hospital he showed signs of effusion, with enlargement of the liver. For seven days he was under my charge. At the end of ten days the aspirating needle was inserted by Dr. F. A. Packard, and about a pint of pus was removed from the liver. I believe the man entirely recovered, though he has since been lost sight of.

In these acute cases, also, there is marked leucocytosis at first. In the chronic cases the leucocytes are scarcely if at all increased, and no evidence in this respect is given of what is going on in the liver.

Pain is not of much importance. Sometimes the liver is tender, but it gives no great amount of pain, except on pressure; sometimes pain is absent.

BENCE-JONES ALBUMOSURIA, WITH REPORT OF THREE CASES: A REVIEW OF THE LITERATURE.

By JAMES M. ANDERS, M.D.,

AND

L. NAPOLEON BOSTON, M.D.*

[Read June 4, 1902.]

Albumose may appear in the urine as a result of pathological conditions, and is dependent upon the decomposition of organized proteids, except in cases of the enterogenic form. It may owe its origin to the action of bacteria upon the tissues, or it may result from the action of certain chemical poisons (phosphorus). It is also observed in connection with the various cirrhoses of the liver, acute yellow atrophy, gastric cancer, gangrene, acute or chronic suppuration, acute inflammations of the serous surfaces, leucocythæmia, the acute infectious fevers, after death of the fœtus, and normally during involution of the uterus.

Rarely has Bence-Jones albumosuria been observed to be a coexisting feature of primary lesions of the bones (myeloma), and at least one of the cases reported below exemplifies this form of the condition. In 1847 Henry Bence-Jones[1] presented the first recorded instance before the Royal Society of London, and three years later MacIntyre[2] published a clinical report of this case. The discovery of Bence-Jones appears to have received but little attention for a period of twenty-two years, when Kuhne (M. Solly reported a questionable case, however, in 1864) detected this substance in the urine; but it was not until 1883 that Kuhne[3] pub-

* Not a Fellow of the College.

lished a report of his observation in connection with the clinical history by Stokvis.[4] In 1889 Kahler[5] and Huppert[5] reported a case from a clinical and a chemical standpoint respectively; Stokvis[6] records a second case in 1891, Seegelken[7] a case in 1895, and Bozzolo,[8] in 1897, records another under the caption "Sulla Mallatia di Kahler," thus recognizing Kahler as the first one to designate the relation existing between albumosuria and primary bone lesions. Von Rustizky,[9] as early as 1873, however, classified these lesions as "multiples myelom." Rosin (Senator),[10] Ewald,[11] Fitz,[12] Naunyn,[13] Bradshaw,[14] Ellinger,[15] J. A. Milroy,[16] and J. H. Wright[17] contributed cases during this year. Vladimer de Holdstein,[18] Sternberg,[19] Askanazy,[20] Raschkes,[21] Hamburger,[22] Kalischer,[23] Rostoski,[24] Jochmann and Schumm,[25] A. Gutterink and C. de Groff,[26] and H. F. Vickery[51] have also made valuable contributions to the literature of the subject.

Since the original publication of Bence-Jones' discovery of albumosuria associated with "osteomalacia fragilis rubra" there have appeared in the literature records of twenty-one cases where neoplasm of the bones, regarded as probable myelomata, was disclosed at autopsy. In eight cases the tumors were observed antemortem. In addition to those cases displaying a coexistence of albumosuria and primary myelomata, von Jaksch[27] and Fitz[28] each have found albumosuria in a case of myxœdema, and Askanazy[29] noted it to be a prominent feature in one of lymphatic leukæmia, while Zuelzer[30] observed this body present in the urine of a dog poisoned by pyrodine. To the above cases, thirty in all, should be added three of albumosuria that occurred in our own experience, and are herewith reported.

Case I.—H. T., aged thirty-two years, first came under the care of one of us (Boston); exceptionally well developed and fond of athletics; carpenter; born in California. Had diseases of childhood, including scarlet fever at the age of fourteen years, after which period he enjoyed perfect health except for an attack of malaria at twenty years, which was followed by several relapses, continuing over a period of more than a year.

Family History. Father died of Bright's disease at fifty-six years of age, mother of apoplexy at fifty-five; both large in stature, weighing over 200 pounds. A brother and a sister died during childhood, cause unknown.

History of Last Illness. On September 20, 1900, while working at his

trade, he fell from the second story of a building to the cellar, a distance of twenty feet. He was found unconscious by his fellow-workmen and taken to the hospital, where he soon recovered consciousness and was allowed to walk to his home. As a result of this fall he complained of soreness in his back, confined to the lower dorsal and lumbar regions, but returned to his work a week later.

During the latter part of November, 1900, he developed a typical form of herpes zoster affecting the right side. At this time he was voiding 2900 c.c. of a pale urine during the twenty-four hours. He first noticed intense thirst, which was allayed only by drinking large quantities of water. During December he complained of weakness, dimness of vision, which caused him to remain from work for a time, and pronounced frontal headaches. Early in January, 1901, he returned to work, when, on lifting a timber, he was seized with severe pain in the lumbar region, accompanied by a feeling of "giving away of the backbone," as he expressed it, and was carried to his home. At this time tenderness could be elicited by deep pressure over the lower dorsal vertebræ, and this was also present, though less marked, over the lumbar vertebræ and crest of the right ilium. There was more or less constant pain in these regions and in the right thigh.

Two weeks later he experienced a similar "giving away" in the right hip while ascending the stairs. Repeated subsequent attacks of this nature, affecting either the hip or back, were experienced. In February the patient stated that he had lost sixty pounds in weight during the previous twelve weeks; he now weighed 135 pounds. There were decided pallor, a peculiar expression, the eyes having a staring prominence, with œdema beneath them, which at times involved the entire face and greatly distorted the features. Œdema of the hands and feet was present, that of the latter increasing as the disease advanced.

March 10th he was seized with intense pain over region of the liver, which followed an attack of vomiting. There was now present a small nodule, apparently developing from the eighth rib, in the mid-axillary line. This soon grew to the size of a horse-chestnut. Both the patient and the nurse insisted that this lump enlarged during each paroxysm of vomiting, and that firm pressure over the tumor diminished its size and gave the patient almost instant relief from pain. At about this time he complained of pain (cramp-like) in the right thigh and of extreme tenderness on the inner surface of the femur at the junction of its upper and middle thirds. April 22d, or date of death, this region displayed a tumor the size of a hen's egg developing from the femur. Neither crepitus (a symptom to which other observers have called attention) nor fluctuation was present. A tumor had protruded from the posterior border of the right tonsil, which interfered with deglutition and prevented the use of solid foods. This mass was also painful, but the mucous surface of the throat presented nothing abnormal.

The area of cardiac dulness was slightly increased downward and to the left. A soft systolic murmur was audible at the apex and transmitted for a distance of three inches toward the axilla. There was also a soft systolic murmur heard over the base of the heart (hæmic) and faintly transmitted to the carotids. The pulse ranged from 75 to 120 beats per minute, but was slow in proportion to the degree of prostration. Later it became compressible and intermittent. There was no atheroma of the arteries. Epistaxis was copious and frequent.

Vomiting both before and after the taking of food was an early feature, and persisted throughout. Constipation developed early. Cephalalgia was constantly present in the frontal region, but occasionally became parietal and occipital. Upon firm pressure an extremely tender area was detected over the left orbit. The hearing was dulled and tinnitus annoying. Insomnia became marked about January 1st, after which he was unable to sleep soundly without the aid of drugs. Cramps in the lower limbs, at times limited to the thighs, caused great suffering.

The voice was husky, the speech slow and somewhat drawn. In addition to the decided loss of sight, before mentioned, and the constant floating of specks before the eyes, an ophthalmoscopic examination by L. Webster Fox disclosed choked disk, retinal hemorrhages, and the white deposits common to chronic nephritis. Marked pain on voiding urine, which continued throughout the act, was a late symptom.

The hæmoglobin was found to fluctuate between 52 and 70 per cent.; red cells from 3,500,000 to 4, 100,000; white cells, 8000 to 16,000. The red cells reacted normally to stains, but poikilocytosis was well marked. In the stained specimens the white cells showed nothing abnormal. The urine contained Bence-Jones albumose (*vide* infra). No autopsy was permitted.

CASE II.—W. R. S., aged forty-three years, married, occupation merchant, and temperate as to eating and drinking, came under the care of one of us (Anders) on November 18, 1901. The family history reveals gout, rheumatism, and intense headaches among his ancestors. The patient had had children's diseases, including three attacks of measles; he had also been troubled with neuralgia during adolescence. Three years ago he met with a bicycle accident, which resulted in a fracture of the right leg, and, although recovery ensued, he has since then complained of pains in the seat of fracture. One year ago developed acute articular rheumatism, lasting three weeks. For a considerable period of time has suffered at intervals from severe cephalalgia affecting the left side of the head.

In January, 1901, first discovered certain urinary phenomena, which were interpreted by his former physician as belonging to nephritis. He became dyspnœic, and at times suffered from cardiac palpitation. The rheumatoid pains have been recurring at brief intervals until the present. There has been no febrile movement observed, but there has been a rapid reduction of the body weight during the past four months. His usual weight in

health was 219 pounds, while at present it is 167 pounds. Hand-in-hand with the rapid loss of weight the strength has also declined, and the patient often alludes to a sudden "giving way" of one or other leg while attempting to walk. There have been four severe attacks of nose-bleeds since March, 1901.

The speech is thick, blurred, and slow, the tone dry and leathery, resembling the voice in myxœdema. The patient often makes complaint of intensely painful shins, especially when they are warmed by the bedclothes. Occasional pains affecting the lower extremities and wandering pains about the arms, shoulders, and back are complained of, and insomnia has been a troublesome feature during the past three months, although he sleeps well for a single night at intervals of several days. Violent headaches in the form of hemicrania affecting the left side have been present for a period of about four months. This symptom remits and occasionally intermits, but it is exceedingly severe at some portion of each day, particularly during the early morning hours, and demands anodynes for its relief. Pressure above the left orbit shows a painful, tender spot corresponding with the point of emergence of the supra-orbital nerve. The sexual function has been in abeyance for a considerable period of time. The appetite is poor and the liver function decidedly sluggish. In order to regulate the bowels the patient has been obliged to use a laxative daily. Vomiting occurs at irregular intervals—at times on rising in the morning, and again, though less commonly, after food. Walking early induces fatigue. The temperature is slightly subnormal as a rule.

Physical Signs. The left ventricle is slightly hypertrophied and the aortic second sound perhaps slightly accentuated, but the pulse is weak, soft, and compressible. No murmurs are audible over the precordium. The eyes bulge, and the gaze is staring; the skin presents a dirty yellow or sallow color; the facies expresses suffering, as a rule. No tumor masses have been detected, although skull, sternum, and shins are tender to pressure. The urine contained Bence-Jones albumose, a symptom to which allusion will be made later.

Examination of the blood showed: Red cells, 3,750,000; white cells, 23,000; hæmoglobin, 60 per cent. Poikilocytosis marked; red cells react normally to stains. The differential count gave polymorphonuclear, 72.12 per cent.; large lymphocytes, 8.17 per cent.; small lymphocytes, 11.06 per cent.; transitional, 2.9 per cent.; large mononuclear, 5.8 per cent. No nucleated red or eosinophilic cells found; 200 whites counted.

Ophthalmoscopic examination made by L. Webster Fox showed colloid deposits above and below the optic nerve and retinal hemorrhages in both eyes. No evidence of optic neuritis, but considerable arterio-sclerosis. January 7, 1902, patient returned to his home in the country, and his physician there reports that, on account of racking, acute pains in the inferior extremities, he was unable to leave his bed. Exertion seems particularly

painful. About one month ago this patient died. No autopsy permitted.

CASE III.—F. A. B., aged thirty-three years, of German descent, though an American by birth, occupation liquor merchant, first came under the care of one of us (Anders) October 12, 1900. The patient's habits as to the use of intoxicants had been rather intemperate up to a few years ago, since which time, however, no stimulants of any description have been used.

The following significant family history was obtained: Mother died of cirrhosis of the liver eight years ago; father is living at sixty-six years and afflicted with double cataract; he also suffers from gout and rheumatism. One paternal uncle died of Bright's disease.

The patient had had children's diseases, and from the seventh year of age annually suffered from an attack of tonsillitis. When thirteen years old had diphtheria, followed by facial paralysis of the left side. This complication was ascribed to the application of caustic to the throat. Complete recovery did not ensue, and there is still noted an occasional twitching of the muscles, with a tendency to contracture of the facial muscles on the affected side. An ophthalmoscopic examination made by L. Webster Fox gave this result: "The right eye shows colloid degeneration of the retina, as well as sclerosis of the bloodvessels. The white deposits so characteristic of chronic interstitial nephritis are defined above and around the macular region. The macula itself has escaped its destructive influences, which accounts for his good vision. There is a suspicion of hemorrhage here and there throughout these deposits. The optic nerve shows slight infiltration; this may be problematic.

"The left eye shows a normal fundus. There are no deposits and no destruction of the retina. The arterio-sclerosis of the bloodvessels is not so pronounced as in the right eye. This is rather peculiar, as the bloodvessels of both eyes should present the same characteristics. The pupillary reaction is normal and the muscles are perfectly balanced."

The present illness was discovered six years ago during an application for life insurance, when albumin and tube casts were discovered in the urine. No other subjective or objective signs of kidney disease, however, put in an appearance until three years since, when he first observed some maleolar œdema. This symptom has recurred at long intervals, and he has also suffered from occasional headaches during the same period.

The physical signs at the time of his first visit showed moderate enlargement of the left ventricle, with distinct accentuation of the aortic second sound and slight œdema of the legs. The bodily surface looked pale. These signs have not undergone any noteworthy changes up to the present. The urine contained Bence-Jones albumose and other morphological elements, to which detailed reference is made below.

Examination of the blood showed hæmoglobin, 69 per cent.; red cells,

3,200,000 per c.mm.; white cells, 40,000 per c.mm.; differential count gave polynuclear cells, 65 per cent.; large mononuclear, 5 per cent.; transitional, 4 per cent.; large lymphocytes, 15 per cent.; small lymphocytes, 10 per cent.; eosinophiles, 1 per cent.; no nucleated red cells. Poikilocytosis was marked. Apart from some emaciation that has occurred during the last six months, there has been no appreciable change in the general condition of the patient until the present.

The Urine. In Case I. the urine was of a light straw color and displayed a persistent froth on shaking; the twenty-four hours' product equalled 2900 c.c., having the consistence of syrup, faintly acid except for an occasional specimen which was neutral in its reaction; specific gravity, 1002 to 1010. The quantity of urea was practically normal for the twenty-four hours, and it was found to be free from sugar. The total amount of proteid by the Esbach method equalled 0.27 to 0.35 per cent. It was precipitated by nitric, sulphuric, and hydrochloric acids, but was not soluble in excess except by the aid of heat. Thirteen other reagents employed for the detection of serum albumin gave decided reaction for that body.* Casts have not been found at any time. The tests employed have been those suggested by Huppert, Matthes, Milroy, and Magnus Levy.[42][1][2]

1. More striking were the changes observed upon the gentle application of heat to the filtered urine. When heated on a water-bath it showed a slight turbidity at about 50° C., and at from 56° to 60° C. it became opaque, and a white precipitate in the form of coarse flocculi was observed, which for the most part was redissolved at a temperature of 90° to 95° C. A test-tube filled to two-thirds its depth was placed over the flame of a Bunsen burner, so as to heat only the upper third of the column of urine. As the temperature reached 52° to 54° C. an opalescence was observed, which developed into a dense cloud at 56° to 60° C., and formed a rather heavy coagulum when heated to a temperature between 60° and 90° C. The addition of a few drops of dilute acetic acid to the urine caused the opalescence to appear at a lower temperature, 37° C. In case the heating was continued at a temperature

* Boston. New York Medical Journal, May 24, 1902, p. 885. "Albumin in the Urine: A New Way for Applying Nitric Acid and Other Reagents."

of 95° to 100° C. this coagulum would disappear (dissolve) in part and often entirely when ebullition was prolonged for one minute; but when allowed to cool the urine became equally if not more turbid than it was before the boiling temperature had been reached.

2. Upon the addition of concentrated nitric acid, drop by drop, to the urine after heating the upper third of the column it caused a precipitate to appear in the track of the acid as it traversed the cold stratum of the urine to the bottom, where, after the addition of several drops, a rather dense precipitate of a pink or yellowish hue was seen, which on standing developed a slight golden color.

3. Nitric acid added drop by drop, shaking after each additional drop, caused a slight pinkish color, affecting most the heated portion of the column.

4. A specimen of the acidulated urine was gradually heated to the boiling point, cooled, and filtered, and the filtrate thus obtained apparently contained but little proteid displaying a slight opalescence with acetic acid, but no precipitate resulted when nitric acid was employed. The latter caused a pink tint to appear, which became yellowish on the addition of ammonia.

5. A quantity of the urine was placed in a beaker and heated to 52° to 54° C., cooled, and filtered. The precipitate collected was dissolved by washing with a solution of soda, specific gravity 116. When thus prepared it gave well-marked Millon's and biuret reactions. The precipitate when heated with lead acetate and caustic soda—30 per cent.—became blackened, due to the formation of lead sulphide, showing that the precipitate obtained in this manner contains sulphur in considerable amount. Boiling before filtering altered in no way these reactions.

Saturation with Neutral Salts. In Case I. a quantity of urine was saturated with a neutral solution of ammonium sulphate, which completely precipitated the albumose. Saturation with sodium chloride in neutral solution caused a precipitate of but a portion of the albumose, the filtrate giving a decided clouding upon the addition of a small quantity of dilute acetic acid; but the filtrate from the second precipitate did not contain albumose. The body with which we are dealing differs from protoalbumose

and heteroalbumose in that it is not completely precipitated with sodium chloride in neutral solution. It resembles heteroalbumose in that it is precipitated on the addition of acetic acid after saturation with sodium chloride or magnesium sulphate, but differs from this body in being precipitated at a temperature of 52° C. A test-tube containing urine saturated with neutral sodium chloride solution, to which a few drops of nitric acid were added, gave a precipitate on heating, which disappeared on nearing the boiling point, but reappeared upon cooling. Saturation with neutral salt exercised but little effect upon the precipitate caused by sulphuric and hydrochloric acids. It was also precipitated by tannic and picric acids.

After acidulating the urine with dilute acetic acid, and heating sufficiently to precipitate the albumose, the temperature was raised sufficiently to dissolve it; and upon the addition of a few drops of nitric acid the precipitate did not appear, with the usual rapidity, upon cooling.

Urine saturated with neutral salt, to which a few drops of nitric acid were added and the temperature rapidly brought to the boiling point, showed but little tendency to form a precipitate upon cooling. At times this precipitate did not appear for one or more hours. The method commonly employed in these analyses was to saturate the urine with a solution of neutral salt; then a drop or two of dilute acetic acid was added and the temperature gradually raised to the boiling point, filtered hot, and the coagulum collected on filter paper, which was readily dissolved by washing with a solution of soda, specific gravity 116, after which it was tested for Millon's, the biuret, and sulphur reactions.

The filtrate thus obtained contained albumose, contrary to what one would ordinarily expect. Thirty to fifty c.c. were placed in a beaker and a drop of hydrochloric acid added, stirring gently, when a few drops of phosphotungstic acid were added and heat gently applied, which when prolonged for a few minutes caused a copious precipitate to collect at the bottom in the form of a rather tough, whitish mass. The clear, supernatant fluid was decanted, and this second precipitate washed and dissolved in a solution of soda, specific gravity 116, adding drop by drop. This usually

gave a colorless mixture, but occasionally it was noted to possess a blue tint which disappeared when the specimen was gently heated. A 1 per cent. solution of copper sulphate was now added, drop by drop, when a purple color would appear, rapidly changing to a pink or rich claret. On standing a golden-yellow precipitate collected at the bottom of the tube. The second precipitate when dissolved was also treated with Millon's reagent, and gave a bright-red color.

In Bence-Jones', Kuhne's, and Matthes'[31] cases the proteid contained phosphorus, while in Milroy's not a trace of phosphorus was found. No such studies were conducted in connection with our cases; neither was Hofmeister's,[32] Noel Paton's,[33] nor Hopkins' and Pinkus'[34] methods employed for the crystallization of this proteid.

Microscopic study showed the urine to contain few leucocytes, an occasional red blood cell, epithelial cells (bladder), and a few bacteria, cocci, and bacilli, which were only present in the neutral specimens. No renal casts were found, though many specimens were centrifugated and carefully examined.

Polyuria was present in one of Hamburger's[35] cases, who voided 3500 c.c. daily, while Kahler's[36] patient voided 2230 c.c. Case I. of our series passed 2900 c.c. per diem.

In Case II. the urine was, as a rule, feebly acid, occasionally neutral. The twenty-four hours' product was 2500 c.c., more recently only 1875 c.c.; froth in excess; light straw color; specific gravity ranging from 1004 to 1012. The standing specimen shows only a slight amount of sediment. The total proteid estimated by the Esbach method ranged from 0.23 per cent. to 0.001 per cent. Over a period of several months albumose was present at each analysis, the tests detailed above having been employed. During the last month of life the total proteid was much reduced, and a reaction for albumose could not be obtained. In this particular it resembles Stokvis' case, in which the albumosuria disappeared three months before death. The albumosuria, however, did not assert itself in his case until late in the course of the disease, and this may have been true of our case, since the patient had been ill for a long time, and had lost sixty pounds in weight before consulting one of us (Anders).

Microscopically, the centrifugated specimens contained bladder epithelium, amorphous urates, a few leucocytes, and an occasional red cell. Casts were not found. Certain of the specimens contained many bacteria (motile bacilli), and the question as to how this condition might influence the reactions for the Bence-Jones body naturally suggested itself, and further observation showed that the bacteriuria, when present, exercised no influence upon the reactions for albumose.

In Case III. the urine was usually clear, colorless, acid, the twenty-four hours' product equalling 2300 c.c., and of a specific gravity ranging from 1008 to 1012. The total proteid estimated by the Esbach method varied from 0.01 to 0.03 per cent. Serum albumin was always present in large amounts. Bence-Jones albumose, which was first found on October 25, 1901, was not a constant constituent until recently; it has been of late noted at each examination. When the urine contained albumose it was always noted to be of the consistence of syrup, and when a drop was evaporated nearly to dryness it was found to be markedly viscid. This appears to be the sixth recorded instance in which urine containing albumose resembled syrup. In Case I. of our series it was also observed.

Microscopically, small hyaline, granular, and large (so-called amyloid) casts were always present; a few epithelial cells and leucocytes were an occasional finding. Casts were present in Bence-Jones and McIntyre's case, and mention is made of their having been found in cases cited by Senator, Fitz, Hamburger, and Raschkes.

Albumose resembles, in many respects, histon, which may under certain conditions be derived from nucleohiston, a proteid of the leucocytes. According to Milroy, histon resembles more closely globin than albumose, and seems to be an intermediate in its properties between acid albumin and albumose. Histon is precipitated from acid solutions by ammonia, while in albumose no precipitate occurs. Lilienfeld[37] found this body (histon) yielded a precipitate when heated, which was soluble in dilute acids. It was precipitated on the addition of nitric acid; this precipitate disappeared on heating, to reappear on cooling. It gave a distinct rose-pink color with copper sulphate and caustic soda.

Huppert[38] first observed the resemblance existing between albumose as found in Bence-Jones albumosuria and the proteid constituent of hæmoglobin. Schultz[39] has also studied these bodies, and his conclusions are essentially the same as those of Milroy. "The two bodies resemble one another in their behavior on the addition of hydrochloric and nitric acids, and also in the fact that they both give the biuret action. The albumose differs from globin in being less easily precipitated by the addition of neutral salts, in giving a distinct reaction with Millon's reagent, and in containing loosely combined sulphur." When precipitated by heat, globin is readily soluble in dilute acids, a feature less marked in albumose.

Brief notes of the cases furnished by the literature are appended:

CASE I.—Bence-Jones and McIntyre reported the first case, occurring in a male, aged forty-five years, suffering from severe pains in the chest, back, and loins (lumbago) for over a year. The progress of the disease was remittent, decided temporary improvement being noticed from time to time. The chest was tender even on percussion, but presented no deformity except for slight flattening. The urine contained the albumose body now universally known under the caption of "Bence-Jones albumose." During life no disease of the bones was suspected. The appetite was generally good, though several severe attacks of acute gastritis were experienced, and occurred in connection with severe pains in the right side of the chest, frequent attacks of diarrhœa, and painful retraction of the testicles and frequent voiding of the urine, without evidence of urethral or vesical disease, were prominent features. The patient dated his illness from a violent strain received while vaulting out a cellar, fourteen months before consulting McIntyre. As he expressed it, he felt a "giving away" of the chest, accompanied by severe pain; and other similar attacks were experienced during the course of the disease. The heart and lungs were found to show nothing abnormal.

Urine. The urine was at times opaque, acid; forty ounces were voided during the twenty-four hours, and the specific gravity ranged from 1040 to 1022. It became turbid when heated at a temperature of 56° to 60° C. The addition of nitric acid with

boiling caused the urine to clear; but if allowed to stand for one and one-half hours the turbidity would reappear and collect at the bottom of the tube as a firm, yellowish mass of a golden hue, which dissolved by boiling and again consolidated on cooling. Oxalic acid gave a copious white precipitate. Tannin and tincture of galls turned it into a tough mass. At times the coagulum formed after the urine had been removed from the heat, though while heating and during prolonged ebullition no precipitate was apparent. The coagulum thus formed did not melt by renewed boiling.

McIntyre, referring to the reactions with heat and nitric acid, states that at first there is a slightly yellowish opacity, which gradually deepens, and consistency increases until coagulated into a "resplendent mass resembling nitrate of urea scales." No true crystals were present, and the sparkling was due to air bubbles entangled in the mass. On the application of heat to the upper one-third of a column of urine contained in a test-tube "add acid, drop by drop, and as it falls through the cold stratum of the urine it causes a yellow coagulum to form in the track of the acid as it traverses through the fluid to the bottom."

Microscopically, the urine presented renal casts. Bence-Jones isolated this body as an oxide of albumose, the "hydrated deutoxide." He found this substance to be a constituent of pus and of spermatic fluid.

Postmortem. The chest was flattened. Muscles flabby, of a grayish color, and bloodless. The ribs crumbled under the heel of the scalpel, and were noted to be soft and brittle throughout their entire length, crushing under pressure of the finger. Their size was greatly diminished, as was also their weight. The marrow of both ribs and sternum is stated to have been blood red.

Spine. The dorsal and lumbar vertebræ suffered the most change. Their bodies were small—the size of the cervical—and both their bodies and laminæ could be crushed by the finger's pressure. "The pelvic bones were grayish." The long bones could not be broken, but no careful record of their examination is given. A chemical analysis of the bone is lacking. Dalrymple[40] made a microscopic study of two lumbar vertebræ and a rib. He

says "the disease appears to have commenced in the cancellated structure of the bone, for the external osseous laminæ are firmer and more healthy than the internal; they are thin, however, and when sliced expose large, cancellous cavities filled with a red, gelatiniform substance, threaded here and there by fine bone fibres."

Microscopically, this gelatiniform tissue was composed of nucleated cells, granular matter, fat cells, caudate cells, and blood disks. No mention of multinuclear myeloid cells is made, but M. Dalrymple remarks that it bears some resemblance to a malignant disease of the bone.

Case II.—Martin Solon,[41] of Paris, described similar reactions present in the urine of a young female suffering from rheumatism complicated with endocarditis, as early as 1838.

Case III.—Mr. Solly,[42] in 1846, describes a similar condition of the bones, beginning in the cancellated structure and involving the external portion and laminæ, which were also reddened and atrophied. The marrow was composed of granular matter, oil globules, nucleated cells, and a few caudate cells. Blood disks were distributed among the other red cells, giving a red color to the gelatiniform mass.

Case IV.—Kuhne, in 1867, observed the body described by Bence-Jones in the urine of a man, aged forty years. Deformities of the bones of the trunk were observed during life, which led to the diagnosis of osteomalacia. A postmortem was not obtained "In the Stokvis-Kuhne case the albumosuria did not appear until the illness was well advanced, and disappeared three months before death." (Hamburger.)

Case V.—Kahler and Huppert reported a case which they investigated, the patient being a physician who died in 1887, in his fifty-fourth year, having been ill about eight years. In July of 1879 he was suddenly seized with severe pain in the upper portion of the right chest, but in the course of a week he felt entirely well. Six months later, without apparent cause, he had another similar attack, localized in an exquisitely tender area over the right ribs, which also disappeared in a few days. During the following year he experienced several similar attacks, each localized to one of the ribs, and one to the right patella. In 1881,

following a similar attack, a flattened elevation was outlined over the costal surface of the fifth rib. Both pain and deformity disappeared in a short time, but similar conditions were observed later in other of the ribs. Suffering was intense during 1883 and 1884, consisting of pain in the ribs and sternum, nausea, visceral pains, insomnia, and paræsthesia in the lower limbs.

In 1885, when Kahler first saw the doctor, he was cachectic; when standing his face pointed down, the result of a dorsal kyphosis. The urine gave a reaction for albumosuria. Neuralgia of the nerves of the extremities was marked; kyphosis increased and the sternum bulged forward. In 1887 the inguinal glands showed involvement; while the doctor had had imperfect hearing for several years, its impairment was now marked, leading at last to deafness.

The postmortem disclosed an extensive softening of the ribs, sternum, and vertebræ. Microscopically, a condition of marked osteoporosis, with formation of Howship's lacunæ, distinguished by the proliferation of a tissue composed of large round cells—"round-celled sarcoma," now known as myeloma—was noted. There were also bony tumors developing from the various affected bones.

Case VI.—Stokvis, of Amsterdam, observed a case in which there was albumosuria without any evidence of bone affection during life; at postmortem, however, the bones were found to be brittle, and the place of their marrow was occupied by a red, gelatinous mass. The periosteum, muscles, and serous membranes alike displayed numerous firm tumors of a yellowish-white color. The humerus showed decided involvement. The kidneys were apparently normal. No record of a microscopic study appears in connection with this case.

Case VII.—Seegelken, in 1895, reported a case observed in the clinic of Stintzing, of Jena. The patient was a male, aged sixty-one years, who presented a decided kyphosis. The head appeared sunken between the shoulders and the neck shortened. The leading symptoms were severe pains and tenderness in the back and over the chest. It was this case that furnished the basis for Prof. Matthes' elaborate studies on Bence-Jones albumose,

whose conclusions were, in brief, that this body was distinct from digestive albumoses and from all other bodies known to chemistry. Here, again, we find a diagnosis of osteomalacia.

The autopsy disclosed extreme softening of the bones of the trunk. The marrow spaces were enlarged and contained a soft tissue of a bluish-red color. Microscopic study of one of the diseased ribs is stated as follows: "The compact tissue was wanting in places. Where it was present it was very much thinned, and contained numerous wide, irregular lacunæ, filled with a vascular, spindle-celled tissue. Beneath the compact tissue, and replacing it where it was wanting, was a zone of tissue consisting of closely packed round cells intersected by irregularly running bands of spindle cells. It was of unequal thickness, and projected unevenly into the marrow. In it were some rather large islets of cartilage and numerous necrotic patches." The pathological diagnosis was chondrosarcoma.

CASE VIII.—Bozzolo records a case in which there were tumor masses developing from the bones of the shoulders, arms, and ribs. The urine gave reactions for Bence-Jones albumose.

CASE IX.—Senator, in 1897, records the first instance when albumosuria and primary bone disease were found to affect a woman. The patient was aged thirty-six years, and suffered chiefly from paralysis of the hypoglossal nerves, paresis of the arytenoids, anæsthesia over the region of distribution of the third division of the trifacial nerve, and pains in the back and chest. There appears to have existed nothing to arouse suspicion of bone disease in connection with this case, and the urine displayed the usual findings characteristic of nephritis complicated with albumosuria. The nervous symptoms are discussed at length in their resemblance to those of nephritis.

Autopsy. New-growths developing from the medulla were present in several of the ribs. These neoplasms were pronounced to be myelogenous, round-celled sarcoma. The kidneys were found to be in a state of amyloid degeneration.

CASE X.—Ewald records an instance in which all symptoms followed a fall which inflicted severe traumatism to the right shoulder. The patient was a male, aged sixty-two years, a hunter,

who had previously enjoyed perfect health. Following the fall he was unable to lift the right arm to his head, on account of stabbing pain. Rapid improvement followed, but twelve days later a soft swelling was observed, which apparently developed from the right clavicle. Three months later he had lost much flesh, pallor was pronounced, and the right shoulder was drooping and pushed forward. The supraclavicular space was now occupied by a soft, well-outlined elastic tumor, the size of the fist. The skin covering it was normal. The clavicle was freely movable, and pressure caused extreme pain. The mass resembled an aneurism, but operation showed it to be connected to the muslees of the thorax, vessels, and the lung. It was covered by a thin, fragile bony case, which enveloped a peculiar sponge-like network, and after the blood was removed this was of a gray-red color. The tumor was not movable, and hemorrhage could only be arrested by pressure. The red blood cells were practically normal and eosinophiles diminished. The urine contained albumose.

Postmortem. A tumor the size of an apple, covered by a thin plate of bony tissue and penetrated by several spines of bone, was found. The broken bones were of a grayish-red color. The histological findings were practically that of myelomata. Ewald thinks this condition (multiple myelomata) is usually overlooked, and is regarded as marasmus, amyloid disease, etc. He thinks traumatism an important etiological factor.

Case XI.—A. H. Fitz has reported the case of a woman, aged forty-nine years, whose first symptoms were loss of flesh, strength, and color. Later she experienced griping sensations in the back, pain between the shoulders, and a temporary stiffness of the joints. The eyelids were slightly swollen and salivation pronounced, the latter continuing; a sense of numbness in the right heel, knees, and fingers of the right hand. The teeth were troublesome, and became painful, so as to prevent the taking of solid foods. Two years later there appeared an enlargement at the back of the neck, "a lump beneath the jaw, hypertrophy of the tongue, and later indurations in the legs and arms." The voice became changed, and a fragment of dead bone followed the removal of a tooth. The lips were slightly thickened, salivary

glands swollen, the upper eyelids normal, but the lower lids somewhat puffy. The skin covering the back of the hands was thickened, wrinkled, rough, and of a dirty yellowish color, while that of the forehead, back, and extremities was dry, smooth, and not separable from the subcutaneous tissue. The hair was coarse and dry. The red corpuscles were 5,030,000; leucocytes, 11,600; hæmoglobin, 35 per cent.; polynuclear leucocytes, 74 per cent.; lymphocytes, 23 per cent.

The urine contained Bence-Jones albumose and albumin; microscopically, a few red blood cells, and hyaline and granular casts. Albumose varied from $\frac{1}{8}$ to $\frac{1}{4}$ per cent. Urea normal. The diagnosis was myxœdema with albumosuria. No autopsy.

CASE XII.—Naunyn makes a brief report of a case in which pains in the chest resembling intercostal neuralgia were the first symptom. The lower ribs were painful on pressure, and the spine became stiffened and tender.

The urine contained a large quantity of Bence-Jones albumose. No renal casts or blood cells were found. Naunyn regarded the case as one of multiple myoma. Magnus-Levy[421a] has made an exhaustive chemical report upon the urinary findings in connection with this case.

CASE XIII.—T. R. Bradshaw and W. B. Warrington observed a case in 1897. The patient was a male shopkeeper, aged seventy years. During the course of the disease there developed in rather rapid succession tenderness over the ribs, sternum, back, and spinal column, and later fractures of the ribs. Attacks of bronchitis, pneumonia (with rusty sputum), deafness of one side, and persistent uncontrollable vomiting with constipation comprised the leading symptoms. Examination of the blood showed red cells 1,750,000. Leucocytosis was not present, nor were poikilocytes common. There had been a wart on the nose for many years, and this when removed, during life, proved to be "rodent cancer."

The patient had voided turbid urine at intervals for years, but in 1896 it was noticed to be milky and rarely of the appearance of coffee. The twenty-four-hour product equalled 1220 c.c., and was, as a rule, clear except when voided between the hours of 11 A.M. and 5 P.M., when it was turbid (milky). The urine was

viscid (syrupy); specific gravity, 1015 to 1022; acid, precipitate heavy, urea normal, and was free from sugar and casts. Bence-Jones albumose was observed.

Postmortem, conducted thirty-nine hours after death, showed the bones of the thorax, ribs, sternum, and vertebræ to be so fragile that they could be crumbled or broken by slight pressure of the fingers. Several fractures which had occurred during his illness were also found. The sixth rib on the right side was broken at a point three inches from its cartilage. The seventh rib displayed an incomplete fracture. The fifth and sixth ribs of the left side were broken about one-half inch from their cartilages. The sternum was involved; the gladiolus presented a large, irregular cavity containing a reddish mass which resembled splenic pulp. There was a backward curving of the dorsal spine, while the lumbar vertebræ and promontory of the sacrum were inclined forward. The vertebræ could be cut with ease.

The right kidney weighed two and a half ounces; mottled, capsule somewhat adherent; a cyst the size of a chestnut was found to occupy the cortical portion. On transverse section a dense yellowish material occupied the outer third of the organ. Left kidney resembled the right; it, too, contained a cyst the size of a pea. No glandular involvement and no tumors developing from the bones were observed. The compact portion of the affected bone is stated to have been as thin as note-paper, and the marrow to have given the reaction for Bence-Jones albumose.

Microscopically, the cancellous portions of the affected bones were found to be infiltrated with a round-celled growth which extended along the course of the vessels. Islets of bone were seen among the cells. These cells were of the lymphoid variety, displaying a single large nucleus. Occasionally a few oval and spindle cells were seen. Numerous red blood cells were observed, but none of these was nucleated. There were found large cells having single, double, or reniform nuclei, but these appear to bear no relation to the red cells, and were probably leucocytes. The bones showed no attempt at transformation into a lower type of connective tissue, yet a transverse section of a rib appeared to have undergone some retrograde change.

The changes in the kidneys were practically that of chronic interstitial nephritis. Mr. Collingwood Williams[43] made an analysis of 0.117 gramme of bone (rib), which consisted of organic matter 45.85 per cent.; mineral, 54.15 per cent.

CASE XIV.—Ellinger reports an instance—that of a male, aged forty-five years, who had suffered from daily chilly sensations, followed by fever and sweats, pronounced prostration, loss of appetite, and jaundice. A month later prostration had increased, and the clinical picture resembled progressive anæmia. The urine contained Bence-Jones albumose. The sputum was bloody, and there was evidence of effusions into the serous sacs. Extreme tenderness over the sternum became a late but prominent symptom.

Postmortem disclosed the presence of multiple new-growths of the bone, which should doubtless be regarded as multiple myeloma.

CASE XV.—Milroy detected Bence-Jones albumose in the urine of a patient in the Manchester Infirmary. The clinical history, by Dreschfield,[44] points conclusively to new-growths of the bones.

"A nodular, hard, painless growth was observed on one of the lower ribs on the right side." There were also lesions of the vertebræ. The patient could not be traced after leaving the Infirmary.

CASE XVI.—James H. Wright has reported the case of a male, aged fifty-four years, who presented a tumor in the sternal region. There were numbness of the feet, double vision, and strabismus. Lesions of the ribs were detected by the Röntgen rays. Knee-jerks were exaggerated and ankle-clonus pronounced. The urine contained Bence-Jones albumose and serum albumin. There was incontinence and loss of sexual power. Blood examination gave: red cells, 4,700,000; white cells, 5000; hæmoglobin, 60 per cent.

In connection with this report the pathological changes of multiple myeloma are discussed at length.

CASE XVII.—Vladimer de Holstein has made both a preliminary[45] and final[46] report upon the case of a male, aged seventy years, who presented deformities of the bones, including a growth at the left side of the nose which encroached upon the left eye. There were also decided loss of flesh and strength, with anæmia.

The urine was pale—specific gravity, 1015 to 1022—and had the consistence of syrup, yet no reactions for sugar were present. Upon standing there was a spontaneous precipitation of the albumose, and this white, amorphous precipitate occupied about one-sixth of the entire volume of the liquid. No renal casts were found. Autopsy revealed the presence of multiple myeloma.

Case XVIII.—Sternberg makes mention of a case—a male, aged twenty-four years—who had pains and fever for some time before coming under his observation. The pains were most severe in the chest, limbs, and later in the arms. These pains were at first neuralgic and paroxysmal, but later they became nearly constant, and were much worse at night. There was an intermittent temperature, resembling that of malaria. Pallor, emaciation, and prostration were marked. Later the sternum, ribs, and bones of the extremities thickened in portions, and were painful on pressure. There was also slight enlargement of the lymphatic glands and a moderate pleural exudate of the right side. Duration of illness, eighteen months.

Postmortem showed new-growths of the flat bones, with deformities.

Case XIX.—Askanazy's case of albumosuria associated with lymphatic leukæmia was that of a male, aged fifty-one years, who was first seen by him in 1897. At this time he complained only of feeling weak and of loss of weight. Six months later enlargement of the clavicular glands, with œdema of the feet, legs, and abdominal walls, was noted. The cervical, axillary, and subcutaneous glands became involved later. The blood presented the changes common to lymphatic leukæmia. The patient's illness existed for about one year. The urine gave the reactions for Bence-Jones albumose.

Postmortem, in addition to the glandular enlargements detected during life, showed the ribs to be thin, and four of them were fractured. The marrow of the bones was thick, gelatinous, and of a meat-red color, and under the microscope it was found to consist chiefly of colorless cellular elements, the most of which were lymphoid in character. The lymphatic glands showed hyperplasia.

Case XX.—Arnold Raschkes reports the case of a female, aged sixty-five years, who was married at forty years, but never bore any children. The first symptoms were pain over the frontal bone and cramps in the right foot, which were frequent and lasted but a few seconds. Later there were bone pains in the lower extremities, pelvis, and thorax. The sternum was bulged forward, and there appeared to be dislocations at the sternoclavicular joints. Pressure over the ribs elicited crepitus and caused extreme pain.

The urine was of a pale yellow color, specific gravity 1010 to 1028, faintly alkaline as a rule, and contained leucocytes and amyloid casts. The total proteid reached 0.13 per cent., 0.04 per cent. of which was albumose, the remainder serum albumin and globulin. A few days before death no albumin was present, but albumose persisted. Death was caused by pneumonia.

Autopsy disclosed new-growths in the bones of the thorax and pelvis, and chronic nephritis. No microscopic study of the diseased bones is given.

Case XXI.—L. P. Hamburger reports two cases. The first was that of a woman, aged forty-nine years, who, previous to August, 1900, had enjoyed perfect health, when she was seized with a severe pain over the ninth left rib near its cartilaginous attachment. At this point tenderness was pronounced and pressure painful. Crepitus was not observed. Iglehart,[47] who saw the patient during the attack, regarded it as a probable fracture of the rib. All symptoms had disappeared in three weeks. A month later she suffered from nausea, and had lost thirteen pounds in weight. The patient had been taking large quantities of water, and voided more urine than usual. At this time the urine was found to contain Bence-Jones albumose, the twenty-four hours' product being 3500 c.c., pale, acid in reaction, and of a specific gravity of 1004. In the Esbach albuminometer the proteid reached 0.27 per cent. The sediment did not contain casts.

Later there were frequent attacks of intractable facial neuralgia, much nausea, and pain in the left thigh, which finally incapacitated her from standing or even sitting. There was a fracture of the left thigh produced while changing the bedlinen. Ever recur-

ring nausea and uncontrollable vomiting persisted during the last ten days of the disease. Duration of illness, one year. Albumosuria was always present. No autopsy permitted. Charles E. Simon[48] has made a further report on the chemical study of the Bence-Jones body in connection with this case.

Case XXII.—The second patient was a colored woman, aged fifty years. On lifting a scuttle of coal she experienced a sense of "giving away" of the left arm. The following day it was painful and movements limited. A week later the right arm was similarly afflicted, when she had, in addition, pain in the shoulder, back, neck, and chest. She then noticed a swelling, the size of a hen's egg, on the occiput, which was not tender nor adhered to the skin. Later, while walking, she experienced a "giving away" of the right leg, without cause, which was followed by extreme pain. She lost much weight during her illness. There was a tumor developing, 4 cm. in diameter, apparently connected with the acromion process of the scapula. The upper third of the right thigh presented a tumor "about the size of a child's head." Examination of the blood showed: red cells, 3,548,000; leucocytes, 4500; hæmoglobin, 52 per cent.

The urine was turbid, light yellow in color, and the product of twenty-four hours 600 to 800 c.c. It was alkaline or neutral in reaction, the specific gravity varying from 1012 to 1030. Bence-Jones albumose was present, and the sediment contained hyaline casts. W. C. MacCallum[49] has reported in great detail the post-mortem findings in connection with this case.

Anatomical Diagnosis. "Multiple myeloma; tumor masses in the femur, ilium, clavicle, sternum, and scapula, with pathological fractures. Tumor mass protruding from the skull. Chronic nephritis; arterio-sclerosis; myomata uteri; healed tuberculosis of the lungs."

Right clavicle presented a healed fracture. Marrow showed tumor masses, but no erosion of the bone. The ribs were normal. Both the right ilium and scapula presented growths which had eroded these bones. The shaft of the right femur was fractured; its cavity was invaded by the new-growth, which was of a dark purple hue, and appeared to push ahead of it the yellow marrow.

These growth-masses were often of a deep red color, displaying streaks of a grayish tint. Their consistency varied; in some it was gelatinous, in others firmness of texture was noted.

Microscopically. These masses are composed of a delicate stroma with wide meshes in which the cells are deposited rather loosely. These cells vary slightly in size and form, being usually round and presenting a large, round, vesicular nucleus. The protoplasm is granular and rather ragged. Numerous blood-vessels were found in these tumor masses, and were in intimate contact with the tumor cells. Red blood cells were everywhere pesent, and MacCallum regards the red color of the growths as ascribable to their presence. Methods for the further determination of these cells were employed.

CASE XXIII.—S. Kaliseher reports the case of a female, aged sixty-seven years, who had four children, the eldest, a daughter, dying at the age of thirty years of progressive pernicious anæmia. The initial symptom was neuralgia, which was often paroxysmal. There followed, in rather rapid succession, prostration, emaciation, mental dulness, insomnia, gastric irritability, anorexia, and constant pains in the chest. She was unable to walk on account of pain. The pain was most severe over the fifth, sixth, and seventh ribs of the left side; but other ribs and the sternal, clavicular, and scapular regions often shared this agonizing symptom.

The patient constantly complained of a bitter taste. The eyes were normal. The urine was pale, neutral, or feebly alkaline, specific gravity 1015, the twenty-four-hour product equalling 2000 c.c. It gave the reaction for Bence-Jones albumose.

Autopsy. The ribs were roughened and presented numerous new-growths. The second to the eighth ribs on the left side were freely movable, and their vertebræ were softened. The sternum, scapulæ, and clavicle were also softened. All diseased bones could be cut by seissors, and cut surfaces showed marrow to resemble splenic pulp. These bones presented only a thin, paper-like easing. A microscopic study accompanies this report.

CASE XXIV.—Rostoski describes the reactions for Bence-Jones albumose in the urine of a patient under his observation,

but no reference is made to either the clinical history or to any autopsy.

Case XXV.—Jochmann and Schumm, in 1891, reported the second instance since the original publication of Bence-Jones, in which albumosuria developed during the course of osteomalacia, the other being that of Raschkes, in which case no microscopic study of the growths was made.

The patient was a female, aged thirty-seven years, who first complained of severe pains in the thighs, but later there was pain over the sternum and from the second to the fourth ribs on each side. There developed in rapid succession pains in the spine, bulging forward of the sternum and irregularities of the ribs, and spontaneous fractures of the femur. These deformities were studied by the Röntgen ray and also at autopsy. There were decided emaciation, pallor, and weakness. The right eye showed retinal hemorrhages, the left glaucoma. The urine was clear, brownish-yellow, acid, and contained 0.2 per cent. of albumin by the Esbach method, and by the Latin method 0.7 per cent. Microscopically, epithelium, renal casts, and leucocytes were found.

Autopsy. The diseased bones showed their central portions to be occupied by a substance which resembled "raspberry jelly." The outer casings of these bones were as thin as paper, and could be cut with ease.

The microscopic report appears to leave room for question as to whether this case was one of true osteomalacia or myeloma. The kidneys presented both interstitial and parenchymatous, with slight amyloid, changes.

Case XXVI.—A. Gutterink and V. J. de Groff have made a chemical report of a case which occurred in the clinic of Hijman van den Bergh, of Rotterdam. As yet we have not observed a clinical report of this case. These writers were able to precipitate and crystallize at will the Bence-Jones body. A further study of this body is also in progress.

Case XXVII.—J. A. Blair[50] makes a brief report of a case of a male, aged sixty-four years. While under his observation paroxysmal attacks of vomiting were the principal symptoms. During these attacks the temperature rose to 101° to 102° F.

The urine contained Bence-Jones albumose in large amounts over a period of several weeks.

CASE XXVIII.—H. F. Vickery[51] presented a paper before the Association of American Physicians, April 29 and 30, 1902, "A Case of Albumosuria Associated with Pernicious Anæmia." The patient was a male, aged forty-seven years, an alcoholic. No autopsy. A. Jacobi, of New York, in discussing this paper said that he had seen albumosuria associated with pernicious anæmia.

CASE XXIX.—John H. Musser writes us that he has observed albumosuria in a female, aged fifty-six years, single, who gave a rheumatic history. She had pernicious anæmia lasting two years, and died in consequence of this disease. Bence-Jones albumose was present in considerable amounts.

CASE XXX.—Buchstaub and Schaposchnikoff[52] report a case in which the early course of the disease resembled that of pseudo-leukæmia. Later, upon the detection of the Bence-Jones body in the urine, a diagnosis of multiple myeloma was made. This latter diagnosis was confirmed by autopsy.

F. P. Weber[53] reports a case which did not show albuminuria or albumosuria, and suggests the term "lymphatenomatosis" instead of multiple myeloma. He cites several instances in which "multiple myeloma" existed without albumosuria. His patient was a male, aged sixty-one years, who presented many symptoms common to myeloma, as pains, anæmia, œdema, kyphosis, and fractures. The postmortem findings were also in accord with those presented by multiple myeloma.

W. G. Spencer,[54] S. Flatau,[55] Paul Grawitz,[56] Hanmer,[57] J. von Rustizky,[58] Markwald,[59] F. W. Zahn,[60] J. W. Runeberg,[61] J. B. Herrick[62] and L. Hektoen,[63] J. Coats,[64] Hermann Weber,[65] H. Nothnagel,[66] H. T. Buthin,[67] and L Waldstein[68] are cited by F. P. Weber as having reported cases similar to that of his own. It has been our privilege to review these reports, which appear under a variety of titles, as "Multiple Carcinoma," Multiple Sarcoma of Bone," etc. Reference is made to these cases in order to emphasize the point that not all cases of multiple myeloma are attended by albumosuria.

A review of the cases of albumosuria available in the literature

—thirty in number—and a more careful study of our own three examples reported above, making a total of thirty-three cases, appear to warrant the following inferences:

Etiology. Albumosuria is a condition which manifests itself after the age of twenty years. Of our series, one occurred at thirty-two years of age, another at thirty-three years, and a third at thirty-six years. Of the cases found in the literature, one developed at twenty-four years, another at thirty-seven years, ten between forty and fifty years, and seven between sixty and seventy years. In the remaining cases the age could not be ascertained. Males are affected in 80 per cent. of the cases. In 15 per cent. of the cases (including two of our own) there is a history of an accident inflicting rather severe traumatism.

Primary lesions of the bones, which should be regarded as multiple myeloma, figured in 80 per cent. of the cases. Of these the bones of the chest, vertebræ, and pelvis suffered most destruction, while one-fourth likewise presented involvement of the long bones—femur, radius, and humerus.

An extreme grade of anæmia has been regarded by many writers as a predisposing factor, while others consider the anæmia to be secondary to myeloma. According to the blood findings in our own cases, the latter view is probably the correct one. Experimentally, albumosuria results from the administration of pyrodine.

Symptomatology. Albumosuria may be persistent, transitory, or, less commonly, remittent, occurring in variable degrees at different hours during the day. In certain of the cases the urine presented this phenomenon (albumosuria) after the disease was well advanced, while in others it disappeared when the disease was at its height. Where the urine contained both serum albumin and albumose the former has been noted to be absent a few days before death. In but two instances was the percentage of albumose estimated.

The specific gravity ranged from 1040 to 1004. In six cases, including two of our own (Cases I. and III.), the urine resembled syrup. Polyuria is mentioned by Kahler, Kahlisch er, and Hamburger, and has been a prominent feature in our three cases. Serum albumin is stated to have been found in conjunction with

albumose in 30 per cent. of the cases, nearly all of which showed either hyaline or amyloid casts. A small amount of serum albumin was present in two of our cases, in the third the percentage was large, while only one of them showed tube-casts. We are forced to regard albumosuria as a condition not dependent upon any known pathological changes in the kidneys themselves, but one that may appear in connection with renal lesions.

Pain is an almost constant feature, a single exception existing. It is usually referred to as bone pains, rheumatism, lumbago, neuralgia, etc. The pain occurs without apparent cause, is severe, and often accompanied by a "giving away" of some portion of the bony skeleton. At times it is dull and constant; again cramp-like, lancinating, and momentary. Pressure over painful bones intensifies it, as does also exercise. While the pains are commonest over the flat bones, the extremities often share this agonizing symptom. Cramps involving the lower extremities are common. Toothache, loosening of teeth, maxillary necrosis, and salivation may develop. Painful deglutition developed late in Case I. of our series.

Facial neuralgia is mentioned in connection with 30 per cent. of the cases. Paralysis of the hypoglossal nerves and of the third division of the trifacial nerve is reported. In another there were numbness and tingling of the feet and legs. One of our cases (Case II.) showed paralysis and twitching of the left side of the face. Cephalalgia is mentioned as a prominent symptom in 70 per cent. of the cases. In Case I. and Case II. of our series it was most troublesome, while in Case III. it developed periodically.

Hand-in-hand with rapid and progressive emaciation are noticed pallor, anæmia, prostration, and gastro-intestinal symptoms, as nausea, vomiting, diarrhœa, and constipation. In one instance jaundice developed early.

Deformities. In 67 per cent. of all cases deformities involving the bones of either the thorax, pelvis, spine, cranium, maxilla, or extremities were apparent during life. Pathological fractures occurring without apparent cause are a common complication, and were observed in one-fourth of all cases. Glandular enlargement is recorded in connection with 15 per cent. of the cases, but in

none of these did microscopic study show the growth of the glands to be identical with those developing from the bones.

Frequent, painful micturition was a late symptom in one of our cases. The urine is said to have been passed frequently in four other cases. Epistaxis proved an early and annoying symptom in two of our cases, and was occasionally present in the third.

Changes in the voice are recorded in 16⅔ per cent. of the cases, while in 12½ per cent. impairment of the auditory function existed. Tachycardia, palpitation, and dyspnœa are repeatedly referred to in the literature, and were prominent in our cases. Insomnia was present in three of the cases furnished by the literature, and in two of our series (25 per cent. of the cases). A moderate degree of pallor has been a constant feature. The skin is dry and harsh, and at times presents a muddy or dirty yellow color.

Mention is made of impaired vision in four cases furnished by the literature. One developed glaucoma and another showed strabismus and double vision. In our cases failing sight was an early and a progressive symptom. Ophthalmoscopic examination revealed selerosis of the vessels, colloid degeneration of the retina, retinal hemorrhages, and white deposits common to chronic nephritis.

Reference is made to a rather severe progressive anæmia in most of the cases—for example, in those of Ellinger, Askanazy, Vickery, Musser, and Fitz—while in our series it was more moderate.

Record of a complete blood examination appears in connection with but eight cases, including the three herein reported. Our cases showed leucocytosis of 16,000, 23,000, and 40,000, respectively; red cells, between 3,200,000 and 3,750,000; hæmoglobin, 60 to 70 per cent. Eosinophilic cells were diminished in one and absent in two of the cases.

Pneumonia as a complication is given as a cause of death in 12½ per cent. of the cases. The duration of the condition is usually less than two years; one case, however, is recorded in which albumosuria persisted for more than eight years.

Bence-Jones albumose is a body more or less closely allied to peptones, globin, histon, and the digestive albumoses, but it dis-

plays certain characteristics unknown to these substances. It is a normal constituent of spermatic fluid, and may be found in pus and in the bone-marrow in cases of myeloma.

In conclusion: Bence-Jones albumose when present in the urine is invaluable as a diagnostic feature in cases of obscure multiple myeloma in which no other symptoms of this disease exist. It also serves in differentiating multiple myeloma from other bone lesions, as carcinoma, sarcoma, osteomalacia, etc.

Albumosuria, if continuous, is of grave prognostic significance, and but a single exception is recorded wherein the disease has not proven fatal in less than two years. Where the albumose has persisted for some time its disappearance signifies approaching danger and probably an early fatal issue. Since serum albumin is a common coexistent of Bence-Jones albumose, its disappearance from such urine may also presage complications of a serious character.

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DISCUSSION.

Dr. David L. Edsall: I think that it is more than worth while to get out of the habit of referring to this condition as simply albumosuria. The excretion of the Bence-Jones body in the urine is a condition that is absolutely distinct from albumosuria, both from a chemical standpoint and from its relation to diagnosis and prognosis. While the presence of the Bence-Jones body in the urine is not absolutely distinctive of myeloma, it is seen, relatively speaking, in large numbers of cases of that affection, and occurs only in scattered instances of other kinds of disease. It is, therefore, always extremely suggestive of myeloma, and may lead to the diagnosis; and it, at any rate, has a grave pathological significance. Ordinary albumosuria, on the other hand, has no relation to myeloma, has no constant pathological significance, and often is of no importance at all. It was at one time taught that the excretion of the ordinary albumoses meant suppuration somewhere in the body, but this has been definitely disproved as a general statement; and it has, of course, been shown that albumosuria of this form may occur in connection with a large series of conditions. The most interesting relation that it now has is probably with pneumonia, for it has been shown with almost definite positiveness that the exudate in pneumonia undergoes resolution as the result of the action of a digestive ferment. The albumosuria of pneumonia, therefore, seems much more readily explainable than does almost any other form. A similar condition probably is the albumosuria seen in the puerperium. In some work that I carried on last summer in helping Dr. Mathes I was led to believe that the albumosuria of the puerperium is the result of autodigestion of the uterus; in other words, that involution of the uterus occurs through actual autolysis. The albumosuria of suppurative processes also has an analogous

interest, because of the fairly certain demonstration that pus corpuscles contain a proteolytic ferment. It is highly probable that a number of pathological processes could be made clearer by further study of the albumosuria associated with them.

I should like to ask Dr. Anders and Dr. Boston about the amount of albumose in the third case, and the nature of the reactions which led them to decide that the Bence-Jones body was present. In cases of nephritis it is extremely important to be very certain as to the nature of the substance present in the urine before deciding that it is the Bence-Jones body. The latter is so closely related to and, in some ways, so imperfectly distinguished from native albumin and globulin on the one side, and from the ordinary albumoses on the other, that it is very easy to make an error in cases of this kind. Ordinary albumose is not uncommonly found in nephritis. If the substance was excreted in large amounts, however, this would of itself be almost distinctive of the Bence-Jones body.

Dr. John M. Swan: At the 1902 meeting of the Association of American Physicians, H. T. Vickery, of Boston, reported a case of pernicious anæmia accompanied with albumosuria. In the discussion Dr. Musser referred to another case of pernicious anæmia in which albumosuria was also present.

Dr. Boston: In our studies we have come in contact with no cases in which albumosuria had occurred in connection with pernicious anæmia, but will add the two cases cited by Dr. Swan.

In answer to Dr. Edsall about the third case, I could see but little if any difference in the reaction from that presented by the others. I was somewhat confused at first on account of finding such a large amount of serum albumin and a number of casts. The reaction for the Bence-Jones albumosuria, especially that with the lead solution for sulphur, was equally positive. Permit me to express my appreciation of the privilege to present this paper before the College in connection with Dr. Anders.

Dr. Anders (closes): I felt that the first two cases were instances of albumosuria associated with primary bone lesions. In the first case it was highly probable that multiple myelomata existed. In Case II. there were present the bone pains, tenderness to pressure, and the usual constitutional symptoms, progressive emaciation and debility. In the third case there was albumosuria secondary to chronic Bright's disease. This was the first case of the sort that fell under my observation. It seems to me that the so-called physiological albumosuria to which Dr. Edsall made reference, and which occurs in subinvolution of the uterus, should be distinguished from the pathological variety. There is but one case recorded, especially in connection with bone lesions, in which it lasted more than two years. The diagnostic value of the symptom is slight, excepting in those cases in which there are symptoms calculated to arouse a suspicion of bone involvement. Whether associated with primary bone lesions or is secondary to nephritis, if it continues it should be looked upon as a serious symptom.

INFECTION OF OVARIAN CYSTS DURING TYPHOID FEVER; REPORT OF TWO CASES; OPERATION; RELAPSE; RECOVERY.

By MORRIS J. LEWIS, M.D.,

AND

ROBERT G. LeCONTE, M.D.

[Read June 4, 1902.]

These two cases seem to us worthy of report for the following reasons:

1. The condition is a rare one, for it of necessity implies the previous existence of an ovarian cyst in a woman suffering from typhoid fever, and the combination is, perhaps, not common. When such a cyst does exist in a typhoid case we have no means of judging how frequently it will become infected during the course of the disease, for statistics are not obtainable on this point. We have been able to collect from the literature only six similar cases, five of which were observed in Germany; but if we remember that the recognition and cultivation of the typhoid bacillus has been possible only during the last ten or twelve years, the apparent rarity of the condition is readily explained. Several cases are on record previously to 1890 where operation was undertaken for the relief of suppurating ovarian cysts, and in which an antecedent attack of typhoid fever had been noted, and it is certainly probable that some of these suppurating conditions were due to the typhoid bacillus, although the bacteriological note is wanting.

2. They are the only cases we can find in which a relapse in the fever occurred immediately following the surgical procedures. In the other recorded cases the convalescence was uneventful.

3. With the exception of Sudeck's case they are the only ones that were operated upon within a few weeks of the beginning of the typhoid fever. In the other cases three to eight months elapsed before operation was undertaken.

Case I. (Dr. Le Conte's case.)—S. N., aged twenty-eight years, Russian, married, housework, admitted to the Pennsylvania Hospital September 10, 1901.

Family history negative.

Personal history negative. Has given birth to four children, one dying at the age of four months.

Present Illness. Five weeks before admission was delivered of a full-term child, and nursed it at the breast for twelve days. She was then very wretched and sick with fever, and had been confined to bed for three weeks.

On admission, temperature 104.8°, pulse 120, respiration 32. Color pale, tongue coated, red edges and tremulous; heart and lungs negative; liver dulness extends one and a half inches beyond edges of ribs; spleen large and palpable a finger's breadth beyond edge of ribs; abdomen soft, not distended, with several rose spots, some of which look typhoidal; leucocyte count, 2600; urine reddish-yellow, flocculent sediment, specific gravity 1020, acid, albumin, granular and hyaline casts; diazo reaction positive. A vaginal examination was made, as the case was admitted under the diagnosis of puerperal sepsis, but, unfortunately, the resident physician made no note of the findiugs. A Widal test taken the day of admission was suggestive, and two days later it proved positive. For three weeks the patient presented symptoms of a moderately severe case of typhoid fever; the delirium and stupor were at times marked, and bronchitis developed with some dulness at base of right lung. The pulse at times was very irregular, and always weak. The temperature averaged about 101°–102°, with occasional rises to 103° and over, and falls to 99°. A blood count, September 21, showed 5450 leucocytes. During the fourth week the character of the temperature changed, and it began to assume a hectic type. At this time also the patient began to complain of pain in the pelvic region, with slight tenderness. Dr. J. A. Scott, one of the hospital staff, who had her in charge, called one of the writers (Le Conte) in consultation. A vaginal examination revealed a large, exquisitely tender, fluctuating mass in Douglas' cul-de-sac, which bulged in the posterior wall of the vagina and pushed the uterus up behind the pubis. The extent of the mass could not be well outlined, owing to the patient keeping the abdominal muscles rigid, but it was estimated that the cyst contained from one to two pints of pus.

The patient was transferred to the surgical wards, but for one week refused all surgical interference. Then she agreed to a simple vaginal puncture to evacuate the pus. A blood count showed 10,400 leucocytes, with 55 per cent. hæmoglobin.

CHART I.

OPERATION
107
106
105
104
103
102
101
100
99
98
97
PULSE
RESP.
DATE
9/10 11 12 13 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

CHART I. (Continued.)

Thirty-seven days after admission the patient was etherized and the abscess opened with a knife through the posterior wall of the vagina. About a quart of fetid greenish pus with many cheesy particles was evacuated. On introducing the finger through the opening, cartilage and bone were recognized in the cyst wall. The diagnosis of a suppurating, teratomatous cyst was then assured. The pus removed was examined by Dr. Longcope, and showed the bacillus typhosus present in large numbers and in pure culture. For the next three days the temperature for the first time went below normal, and did not go above 100.2°. Pus was freely discharged from the vagina, and she received vaginal douches, 1 : 5000 bichloride of mercury. During the next week the temperature gradually rose until it reached 104.4°. This rise was continuous and not of a hectic character, but as the discharge from the vagina was considerably less in amount, it was feared that the pus was being retained in the cyst. A drainage-tube was introduced through the vagina into the cyst, and this was flushed out twice a day with 1 : 10,000 bichloride solution. This, however, had no effect on the temperature, which continued to rise. The leucocytes at this time numbered 5500, and the Widal reaction was positive.

The spleen, which had retracted behind the ribs, again became palpable, and rose spots appeared upon the abdomen. A diagnosis of relapse in typhoid fever was made, and the patient again removed to the medical wards under Dr. Scott's care.

During this relapse the patient was very ill, the temperature reaching 106.4°, and the pulse frequently being 140–160 and very weak. Twenty-seven days after the evacuation of the cyst the temperature reached normal, and soon thereafter became subnormal for the most part. Convalescence was uninterrupted, but a moderate discharge from the cyst continued. She left the hospital fifty-two days after operation, refusing further surgical interference, but promising to return in a few weeks for the removal of the teratomatous cyst.

Readmitted to the hospital March 12, 1902. Vaginal examination showed that the left ovary was the seat of the disease, and that the tumor was about the size of a small orange. It still occupied a position behind the uterus. March 14, 1902, ether was administered, and the cyst, together with the left tube, was easily removed through a median abdominal incision. It was lightly but universally adherent to the surrounding organs. A wick of iodoform gauze was passed through the vaginal sinus and the abdominal incision closed without drainage. The recovery was uneventful.

The following pathological report was kindly furnished by Dr. Longcope:

Macroscopic Appearance. The specimen consists of the left ovary and Fallopian tube.

Fallopian Tube. The Fallopian tube measures about 5 cm. in length. The surface, although somewhat injected, is free from adhesions, and the fimbriated extremity is open, the fimbria being delicate. The wall is not thickened and the mucosa is normal.

Ovary. Occupying the position of the ovary is a mass the size of a lemon, which measures approximately 6 cm. in diameter. The surface is infected and contains adhesions. The mass is irregularly lobulated and feels as though composed of hard cartilaginous portions, varying with soft cystic areas.

On section the tumor appears as a cyst containing grumous, foul-smelling pus, and whose cavity is almost completely filled with irregular growths and projections from the walls. The walls, excluding the outgrowths, are about ½ cm. in thickness and covered with a reddish, velvety membrane. The largest outgrowth is about the size of a walnut. It is hard, and appears to contain cartilage and bone. Its surface is irregular and presents small, velvety cauliflower excrescences, which are sprinkled with minute yellow calcareous plates. Often smaller outgrowths project from the wall, being, in general, similar to the larger one. On section of these masses they are found to be composed of bone, cartilage, fat and glandular spaces, all of which tissues are mixed indiscriminately together. The bony areas are, however, usually confined to the superficial portions.

Microscopic Appearance. Sections are made through different portions of the cyst wall, and the wall is found to contain many varieties of tissue. The cyst is lined by stratified squamous epithelium, with exaggerated papilla formation. No pigment is present, and the horny layer present in skin is likewise absent. Below the epithelium is a fairly dense connective tissue representing the corium. Many sebaceous glands are seen immediately below the epithelium, some of them opening through ducts upon the surface. No hair follicles are found. The greater portion of the corium presents a marked round-cell infiltration. In the deeper portions of the wall, which is composed of a loose connective-tissue framework, several large areas of cartilage are found. In these can be seen irregular masses, taking a deep eosin stain and containing a few contracted nuclei, evidently areas of beginning bone formation. Small ducts and cysts are also met with, being lined by a single layer of high columnar ciliated epithelium. Their lumina contain an irregular stringy substance, which stains blue in hæmatoxylin. In one area they are very numerous, widely dilated, with low cuboidal epithelium, and give the appearance of a multilocular cyst. They are filled with a homogeneous yellow substance. The area is bordered on two sides by cartilage. In other sections masses of cartilage appear surrounded by ducts and glands, and in one place a large tubule lined with high columnar epithelial cells, with cartilage just below it, closely resembles a bronchus. In some sections the wall is filled with small round cells, lying between greatly congested vessels, and in others fat is present in large

amounts. Frequently long bundles of spindle cells, which cross and interlace, are seen, suggesting smooth muscle. Occasionally an irregular mass of bone is present, or a large striated homogeneous mass, taking a deep eosin stain, probably calcified material. Surrounding the vessels are many cells of an epithelial type. In one section a large cyst is found, lined by several layers of columnar epithelium, and filled with granular material and red blood corpuscles. The Fallopian tube is perfectly normal; there are no adhesions about its surface, the walls are thin and the mucosa is delicate.

Diagnosis. Teratoma of ovary; Fallopian tube of same side normal.

Perhaps the most interesting clinical features in this case are: 1. The question of diagnosis between puerperal sepsis and typhoid fever at the time the patient was admitted to the hospital. 2. When convalescence should have been established the fever did not touch normal, but assumed a hectic character, with coincident abdominal pain and enlargement. The leucocytes, which had previously been subnormal, doubled in number. 3. After the pus was evacuated the question of whether the steadily rising temperature was due to retained pus or a relapse. This was positively cleared up in a few days, when the leucocytes again returned to a subnormal number, the spleen again became palpable after having returned to a normal size, and the appearance of a new crop of rose spots. 4. To what should the relapse be attributed? This will be discussed further on.

Case II. (Dr. Lewis' case.) Mrs. ——, aged thirty years, family and previous personal history negative. Patient was married in September, 1900, and in May, 1901, had a miscarriage in the third month of gestation, apparently caused by overexertion in packing trunks, etc., preparatory to moving.

Curettement was performed, under ether, by Dr. B. C. Hirst, and the patient made an uneventful recovery. An examination made one month later showed the pelvic organs to be in a perfectly healthy condition. During the following summer patient was said to be not quite in her normal state of health, although she menstruated regularly, and considered herself well. On December 1, 1901, she contracted typhoid fever while in Philadelphia. The temperature by the end of the first week registered 104° and over, and the case assumed all the aspects of typical typhoid fever. Spots appeared, the Widal reaction was prompt and positive, and the spleen was slightly enlarged.

Nothing unusual occurred during the course of the fever, except that it

was of long duration. For eighteen days the average temperature was about 103°, after which there was a gradual decline until January 5th was reached, a period of thirty-six days. The treatment was sponging and ice-bags to the abdomen; naphthol was administered during the whole course of the disease, and whiskey, strychnine, and digitalis were given as seemed called for. The bowel movements, which for the earlier portion of the attack were typical in character, now began to be formed and normal in appearance, but the patient was far from well; she was occasionally slightly delirious and had persistent mild delusions. On the thirty-seventh day, when it was hoped that the patient was entering upon convalescence, the temperature rose to 102.2° in the evening, to fall to 97.4° by the next morning. There was no chill, and, with the exception of slight nausea, the patient felt fairly comfortable. Examination of the abdomen was absolutely negative.

During the next two days the temperature oscillated greatly, falling as low as 97.6°, and rising once to 103.6°. No chills accompanied this, and no true sweating, although there was rather free perspiration. Dr. Robert N. Willson's report of the examination of the blood on January 9th, the fortieth day, is as follows: "Blood flows easily and is of good color. Hæmoglobin 95 per cent. Coagulability normal. Red corpuscles 4,932,000, white corpuscles 7800. No malarial plasmodia. No pigmented lencocytes. No poikilocytosis."

No differential count was made. On the seventh day of the supposed relapse one doubtful spot was seen, and by this time the temperature-range averaged over 103°. She began to complain of pain in the legs, and by the tenth day had for the first time a decidedly chilly sensation. No cause for this condition could be detected. There was neither cardiac nor pulmonary complication, nor could careful search determine any spot of tenderness in the abdomen, although the latter was somewhat tympanitic. An examination of the urine showed specific gravity 1009, acid, amber, turbid, sediment abundant, white, flocculent, albumin none, sugar none, urea 0.972 gm. per 100 c.c. Microscopically, full of bacteria in active motion (typical motion and shape of typhoid bacilli), full of lencocytes, very few scattered renal cells, no casts, no crystals, few squamous cells.

By the twentieth day the temperature averaged a little over 100°, and a second examination of the blood revealed "blood rather pale, coagulation normal, hæmoglobin 70 to 75 per cent., red corpuscles 3,832,000, white corpuscles 4800, polymorphonuclear cells 90 per cent., no evident poikilocytosis." On the next day some pain in defecation was noted and also a slight asymmetry of the abdomen, the lower portion of the left rectus apparently bulging a little. No tenderness could be elicited on palpation; no mass was noticed, and the percussion-note was tympanitic, the whole abdomen being somewhat tympanitic.

On the twenty-fourth day there was some diarrhœa and acute pain in the

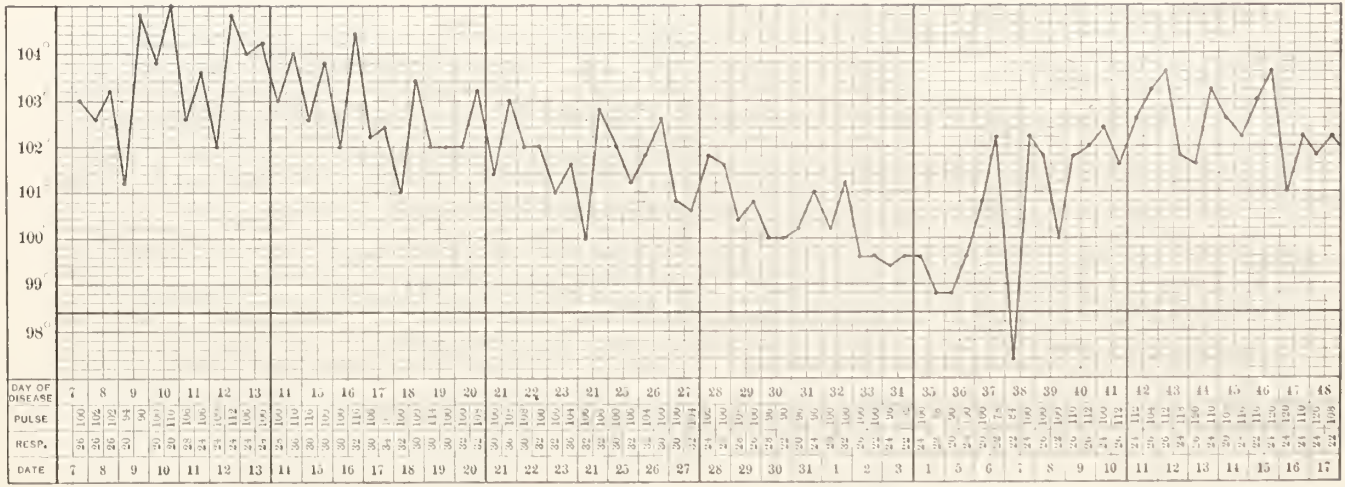
104°
103°
102°
101°
100°
99°
98°
DAY OF DISEASE
PULSE
RESP.
DATE
Dec., 1901
Jan., 1902

CHART II.

CHART II. (Continued.)

epigastrium, which, however, entirely disappeared after the escape of a large amount of flatus. There was now considerable distress in the rectum. Feeling sure that some serious complication existed, a vaginal examination was made, not because the patient complained of abdominal or pelvic pain, but purely for purposes of investigation.

The examination revealed bulging in Douglas' cul-de-sac on the left side, quite sensitive to pressure. A sense of fluctuation was conveyed to the examining finger when percussion was made over the left lower quadrant of the abdomen.

A third examination of the blood revealed "blood fairly good color coagulation normal, hæmoglobin 78 per cent. (color muddy, as of leucocytic influence), red corpuscles 4,264,000, white corpuscles 9200, polymorphonuclear cells 92 per cent., no poikilocytosis."

Dr. Richard H. Harte was called in consultation. The diagnosis of pelvic abscess was confirmed, and operation immediately urged. The patient was at once conveyed to the Pennsylvania Hospital, and in one hour after admission was etherized and the operation performed by Dr. Harte. The abdomen was opened in the median line, and immediately underlying the peritoneum a large cystic tumor appeared, which was adherent to the rectum and to the left Fallopian tube. In attempting its removal entire it ruptured and a large quantity of coffee-colored, rather grumous offensive material escaped, soiling the peritoneum. Owing to its close adhesions to the bowel all of the cyst could not be removed, although most of it was cut away, and the tube and remnant of ovary removed. The ovary and tube on the right side were normal. A small fibroid tumor on the fundus of the uterus was not removed, as the patient's condition did not warrant it. Gauze packing was introduced for drainage.

A culture was made at the time of operation, from the pus from the ovarian cyst, by Dr. Longcope, and this showed subsequently pure culture of typhoid bacilli. The patient reacted well from the operation, the temperature rose during the next twelve hours from 100.2°, which it registered immediately before, to 103.4°, and then gradually fell to 99°.

On the morning of the fifth day the temperature rose to 104°, and subsequently remained at about 102°, and the question arose as to whether there was further trouble in the abdomen or whether it was a relapse of typhoid fever. The abdominal condition seemed to be perfectly satisfactory, and after consultation it was decided that the patient was having a relapse of typhoid fever, a decision which was verified by the subsequent progress of the case.

A blood examination made at this time revealed red corpuscles 4,320,000, white corpuscles 7900, hæmoglobin 60 per cent., polymorphonuclear cells 72 per cent. A rose-spot was noted on February 11th, seven days after the secondary fever. The surgical progress of the case was uneventful. After the fourteenth day of the relapse the temperature remained normal, and the

patient made a perfect recovery, and is, at the time of making this report (June 4, 1902), enjoying apparent perfect health.

The following pathological report was furnished by Dr. Longcope:

Macroscopical Appearance. The specimen consists of the left ovary and Fallopian tube. Springing from the ovary is a cyst which has been opened; it apparently was the size of a small orange. The wall averages about 5 mm. in thickness and is covered by old adhesions; its inner lining consists of a soft, deeply injected tissue. The Fallopian tube is normal; its fimbriæ are delicate.

Microscopical Examination. The cortex of the ovary contains many young follicles and one large follicle. The deeper layers of the cyst wall are composed of fairly dense connective tissue. The superficial layers consist of young granulation tissue, made up principally of large cells of an epithelial type, many of which are phagocytic. Large amounts of yellowish-brown pigment and hæmatoidin are scattered through the middle portion of the wall, and a few polymorphonuclear leukocytes are found, usually in the capillaries. The Fallopian tube is normal. Cultures from the ovarian cyst give bacilli typhosus. No other organisms found. Cultures from the Fallopian tube give negative results.

That relapse should occur five days after the operation in both of these cases is interesting, and the question as to whether the operation held any causal relation to the subsequent relapses was seriously entertained. At first the question arose as to whether it were possible that the operation might have liberated the imprisoned bacilli, like the lifting of the lid of Pandora's box, and reinfected both cases, for it will be remembered that the opportunity for infection was present, in the first case through the vaginal wound, and in the second on account of the rupturing of the cyst during its removal; but further study showed this to be unlikely, and that the relationship was probably coincidental. In Werth's case the cyst containing thin, foul pus was ruptured and a part of its contents spilled in the peritoneum, and in Sudeck's case part of the foul pus escaped and soiled the wound, and from an abscess of the wound which occurred later typhoid bacilli and staphylococci were recovered, and yet no relapse occurred in either case. This explanation of the relapse, therefore, does not appear probable, particularly when taken in connection with the short period of time elapsing between the operation and the time of onset of the relapse, and especially as it is

believed that the typhoid bacillus must gain entrance to the intestines in order to infect specifically. We are still, unfortunately, much in the dark as to the cause of relapse in typhoid fever.

The blood examinations in both of these cases is of much interest, but in neither did the findings modify the views held as to the necessity of operative interference; they served merely as corroborative evidence. In the second case the leucocyte count was 4800 on January 24th, only seven days before the operation, and just before the discovery of the abscess. This count is below the average count of the leucocytes in typhoid fever, which is placed by Thayer at 5860 ("Studies in Typhoid Fever." *Johns Hopkins Hospital Bulletin* 1901, p. 500), while the percentage of the polymorphonuclear cells was above the average of health, viz., 90. Six days later the white corpuscles had risen to 9200, and the polymorphonuclears to 92 per cent., a relative leucocytosis. A week after the operation the leucocytes had fallen to 7900, and the polymorphonuclears to 72 per cent.

Cabot (third edition, 1898, p. 107) states in substance that in some cases in which the absolute number of leucocytes is not increased, we see a relative increase in the polymorphonuclear cells, pointing to the fact that influences are at work similar to those which produce an absolute increase; and again, on p. 195, he states that this increased percentage of polymorphonuclear forms generally betray the presence of some complication, though no increase in the total leucocyte count is present, since during typhoid fever, if uncomplicated, the polymorphonuclear forms are diminished. This case is an interesting corroboration of these statements. In the first case the leucocyte count two days after admission was 2600, and ten days later 5450. Just before operation the white cells rose to 10,400, and a few days after draining the cyst they were down again to 5500. We regret that a differential count was not made in this case.

There can be no question as to the entire recovery of the second case after the miscarriage, and the theory that the ovarian trouble could possibly date from this event is not tenable. First, as the patient was carefully examined one month after the miscarriage, and found to be in an absolutely normal condition, nor had there been

any sign to indicate infection, and second, the examination of the Fallopian tube after its removal proved it to be normal, and cultures from it gave negative results. The cyst in Case II. must have existed previously to the typhoid fever, and then have become infected and grown rapidly in the short time elapsing before the operation, or it may possibly have been an infected Graafian follicle.

The six cases that have been previously reported are appended.

Case I. Werth (*Deutsche med. Wochenschr.*, 1893, No. 21, p. 489). Woman, aged twenty-nine years; typhoid fever without complications in October and November, 1891. In January, 1892, pain in lower abdomen began, and shortly afterward noticed swelling of the part—fever not mentioned. Operation in June, 1892, eight months after beginning of fever. Large dermoid cyst, many adhesions and firmly bound to transverse colon. Cyst contained thin pus with foul odor. During removal the cyst ruptured and part of its contents was spilled in the peritoneum. This was sponged out, but not flushed. Recovery without relapse. Pus showed pure culture of typhoid bacillus.

Case II. Sudeck (*Münchener med. Wochenschr.*, 1896, No. 21, p. 498). Multiparous married woman, aged thirty-two years. Seven weeks before admission to the hospital the patient had typhoid fever. Three weeks before admission noticed swelling of the lower abdomen, with pain and fever of a hectic type.

Operation. Cyst size of a ten-year-old child's head; light adhesions; fluid chocolate-colored and of a very foul odor. During the operation a small amount of fluid escaped from the cyst and soiled the wound. Abscess of the wound later developed, from which staphylococci and typhoid bacilli were recovered. From the cyst fluid pure cultures of typhoid bacilli were obtained. On section, the cyst wall showed many single and diplococci, but no bacilli.

Case III. Pitha (*Centralbl. f. Gynäkologie*, 1897, No. 37, p. 1109). Woman, aged twenty-five years; typhoid fever in October, 1896. Five weeks later noticed a painful swelling in right lower abdomen; no fever.

Operation, February, 1897, four months after fever. Cyst punctured through vagina. Contents, thin yellow pus, without odor. Cyst was found to be a large multilocular dermoid, and could not be thoroughly evacuated through the vagina. It was immediately removed through an abdominal incision; many strong adhesions; recovery uneventful. Cyst gave pure culture of typhoid bacillus. Sections of the cyst showed the inner wall to be necrotic in places, but no organisms were demonstrable.

Case IV. Wallgren (*Archiv f. Gynäkologie*, 1899, Band lxix. p. 15). Married woman, aged thirty-nine years. In 1893 patient noticed a fist-sized, movable tumor in lower abdomen, which very slowly increased in size, but

never caused any particular inconvenience. During June and July, 1898, patient was in bed for six weeks with fever, but no physician was in attendance. After getting about again tumor rapidly increased in size and became very painful. Irregular fever, with frequent chills.

Operation, September, 1898, three months after beginning of fever. Dermoid cyst containing one and a half litres of yellow-green fluid with stale odor; light adhesions, peritoneum œdematous and thickened. Recovery uneventful. Cyst fluid gave pure culture of typhoid bacillus. Sections of cyst wall also showed bacilli.

CASE V. Englemann (*Centralbl. f. Gynäkologie*, 1901, No. 23, p. 633). Married woman, aged thirty-eight years. Typhoid fever in November, 1900; four weeks in bed; relapse in January, 1901, with great weakness, loss of flesh, vomiting, and abdominal pain. Later fever became irregular.

Operation, March, 1901, four months from beginning of fever. Dermoid cyst size of seven months' pregnancy, containing one and a half to two litres of thin yellow-green fluid; few adhesions; recovery uneventful. Cyst fluid showed a pure culture of typhoid bacillus.

CASE VI. Widal and Ravant (*Bull. et Mém. de la Soc. Méd. des Hôpitaux de Paris*, January 30, 1902, p. 45). Married woman, aged thirty-four years. Entered hospital on the tenth day of typhoid fever. For ten days fever ran a normal course, then vomiting appeared, with a distended, tender abdomen. For four weeks these abdominal symptoms persisted, with fever, and then gradually disappeared. Fifty days after admission the temperature was normal, and the patient seemed convalescent. Three weeks later patient was out of bed, and abdominal symptoms reappeared, with fever. Abdominal section revealed a right ovarian cyst containing one and a half litres of blackish fluid. This fluid gave a pure culture of typhoid bacilli. The recovery was uneventful.

NOTE.—Since the reading of this paper there has appeared in the *American Practitioner and News*, June 1, 1902, a report by Edwin Walker, of a case of typhoid infection of an ovarian cyst. The case is briefly as follows: A young married woman, aged twenty years, contracted typhoid fever in July, 1901, the temperature rising to 103° and 104°, with diarrhœa and rose-colored spots. In the fourth week pain was complained of in lower abdomen, with chills, increase of fever, and tumor. Widal reaction was present when the patient was seen by the reporter, in December, 1901. At the operation, on January 4, 1902, a large dermoid cyst was found which contained a gallon or more of pus. The cyst was firmly adherent, and ruptured during the removal, one quart of pus escaping into the peritoneum. The peritoneum was wiped out with absorbent gauze, but no irrigation of any kind was used, and the abdomen was closed without drainage. The patient recovered after mural abscesses. The pus from the cyst gave a culture of typhoid bacillus.

DISCUSSION.

Dr. J. Alison Scott: I think the report of the case serves to impress upon our minds the fact that we have several things to regard when dealing with typhoid fever. It is well known that we may have gall-bladder complications, and some of us have seen typhoid fever operated on for appendicitis, but that cysts and tumors of the ovary will suppurate is perhaps a new thought to many of us. The woman who was under my care in her primary illness seemed to have an ordinary case of typhoid fever, and was not particularly ill. The fact that she did not convalesce led me to make a vaginal examination, and this revealed a large fluctuating mass bulging the posterior wall. During her convalescence, as stated, the fever was prolonged, but she finally made a good recovery.

Dr. H. A. Hare: I think there are several points in this paper which are of interest aside from the unusual fact that ovarian cysts become infected by the bacillus typhosus. We are accustomed to think that the relapse in typhoid fever is apt to be more moderate, but I think the reverse proposition is frequently true. As I understand, in this case the relapse was more violent than the original attack.

Another point, which it is hardly necessary to emphasize in such a body as this, but which is very important for the general body of the profession, is that physicians are too apt to ignore fever which is prolonged unduly after typhoid fever, and to regard it as having little importance. Those of us who see cases of typhoid fever outside of the hospitals cannot fail to be impressed with the fact that the temperature sometimes runs on for a considerable time after lysis ought to have passed. Too often it is regarded as a continuation of the typhoid infection, and other causes are not looked for.

It is surprising that such active suppuration should have taken place in these cysts so early in the history of the case after the infection of the system with this bacillus. From what I know of the subject of secondary abscesses and sequelæ of this character arising in the course of typhoid fever, it was my impression that we usually find these secondary lesions manifesting themselves months, weeks, or even years after the primary attack. It is a well-recognized fact that in gall-bladder affections following typhoid fever it has been months and even years when the particular micro-organism has been found.

It is interesting that the suppurative process should have been so fulminating in character and have so rapidly developed after the primary infection.

Dr. J. M. Anders: The paper calls to my mind a case of a young woman admitted to the Medico-Chirurgical Hospital under the care of Professor Laplace. She was operated upon for abscess of the left ovary. Subsequent to the operation the more characteristic symptoms of typhoid fever devel-

oped, and she was transferred to my ward. The wound did well. No bacteriological study was made of the contents of the abscess, and she afterward passed through a typical case of typhoid fever. I have been impressed with the fact that typhoid fever patients bear operation exceedingly well. Therefore the inference is that when there is an indication for operation we need not hesitate unless an unusually severe infection or some thoracic complication exists.

Dr. A. A. Eshner: It seems to me not improbable that there may have been a pre-existing disease of the ovary, and that the infection, with the typhoid bacillus, was a secondary matter. Such pre-existing lesions rather predispose to this localization of the typhoid bacilli, as shown by cases of a similar kind that have been reported.

Dr. Lewis (closes): In Case I. the relapse was more severe than the primary attack. In Case II. it was milder. In the eight cases, including the two reported to-night, five were infections of dermoid cyst, which, therefore, *must* have existed previously, and have become infected. Whether the cyst in Case II. had existed previously to the typhoid fever, or how it originated, is difficult to determine positively. As mentioned in the report, the examination made some months before the typhoid fever was very thorough, and no tumor was detected.

A STUDY OF TWO CASES NOURISHED EXCLUSIVELY PER RECTUM; WITH A DETERMINATION OF ABSORPTION, NITROGEN-METABOLISM AND INTESTINAL PUTREFACTION.

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AND

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GRAVE gastric hemorrhage, intractable vomiting, and a number of operations provide imperative indications for stopping all food by the mouth. In œsophageal or pyloric obstruction the food taken is often wholly or almost entirely rejected, in which case the same absolute indication is encountered, and even if excessive vomiting does not occur the amount of food that can be made to pass the obstruction is very frequently so small as to be quite insufficient for the maintenance of a nutritive equilibrium. In a considerable series of other cases of varied kinds it is desirable to limit the food by the mouth to a very low quantity or to substitute entirely other methods of feeding.

In any of these circumstances the only feasible method of supplying nutriment is by way of the rectum. Attempts have been made to administer food hypodermically; but while a very limited degree of success has been attained in this way, it is perfectly evident that such a method has very narrow limitations; and it is one that is exceedingly difficult to carry out, and that cannot be attempted except in case of very pressing need.

The value of rectal alimentation is often very differently stated by writers whose position and experience are such as to make

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them capable of forming a judgment concerning this question. For example, the late William Pepper always spoke of rectal alimentation as being disappointing and unsatisfactory. H. C. Wood's teaching is similar. Ewald admits that the use of nutritive enemata can ordinarily not be successfully carried out for any considerable period of time; but he, nevertheless, considers their nutritive value to be very considerable. Leube, earlier, spoke quite enthusiastically of the nutritive value of these enemata; but the last expression from his clinic, although not from himself personally, refers to the results as being "not particularly brilliant." Riegel speaks highly of nutritive enemata, and leads one to infer that by their use a nutritive equilibrium may be maintained for a long time. Fleiner, on the other hand, insists that it is impossible to maintain a nutritive equilibrium by this means; and that we must always consider, when using exclusive rectal alimentation, that the patient is partially starving.

In general it may be fairly said that the great majority of those who have directly investigated the absorption of nutritive enemata recognize that their value is limited, though different authors vary decidedly in the position that they would accord them. Some clinicians, on the other hand, on the basis of observation alone praise their use highly, and either state definitely or intimate that they can supply all needs for a long time; while other clinicians who are equally capable take a much more conservative view or even consider them almost valueless.

It must, of course, be granted at once that if any food is absorbed from rectal enemata, an important gain has been made over an entire lack of food. This needs no demonstration. The main question is to determine how much food can be administered and absorbed in this way, and how nearly it is possible to maintain an actual nutritive equilibrium when a patient is being fed exclusively or almost exclusively by rectum. A recognition of the exact value of this form of alimentation is of much importance, because in many instances the period throughout which this form of feeding is continued must be determined by the general knowledge of its effect upon nutrition: and, frequently, a decision as to the recommendation of operation or as to the period at which an opera-

tion should be undertaken will depend upon the same knowledge. In a communication concerning this subject, one of us,[1] several years ago, presented some brief investigations which demonstrated the fact that in the patient then under observation nutritive enemata had been very imperfectly absorbed; and that the amount of nutriment actually received in this way was far less than enough to maintain a nutritive equilibrium, even in a patient so greatly reduced as was that woman. Her nitrogen-excretion, also, was such as to indicate that she was practically in a condition of starvation. The present communication will serve as a further contribution to the literature of the same subject; and will, at the same time, direct attention to a factor that has been but casually referred to by previous investigators of this subject, and that should have some influence upon one when reaching conclusions.

The two patients studied were women with gastric ulcer, who were admitted to the University Hospital directly after the occurrence of very grave gastric hemorrhage—one of them in the service of Dr. Alfred Stengel, the other in that of Dr. John H. Musser. In both cases the indication for the exclusion of food by the mouth was imperative. Both were at once put upon three nutritive enemata a day. The total amount given in the twenty-four hours was 400 c.c. of milk and six eggs. In preparing each enema two eggs were added to one-third of the total daily quantity of milk; the whole was predigested with pancreatin; sufficient salt was added to make the percentage equal to normal salt solution, and three drops of laudanum were added to this mixture. In each case a cleansing enema of water was given an hour before the nutritive enema. The latter was always given through a long rectal tube, the patient having the hips elevated, and this position being maintained for an hour or more after the enema was given.

The first patient (H.) never had the slightest sign of irritation from the enemata, and had no spontaneous stool during the whole time that the enemata were used. The second patient (N.) did not retain the enemata well for the first day (this was five days before the study of her absorption was begun). After this, however, she also exhibited no evidence of irritation, and had no stool, except after the use of the cleansing enemata. It is important to insist

upon this point; irritation of the bowel could hardly have played any part in furnishing the results obtained.

Each patient was kept upon exclusive rectal alimentation for eighteen days. In each case our investigations were undertaken only after the patient had been on the rectal alimentation for five days, in order that the results might not be disturbed through the presence in the intestine of food-remnants from a previous period and in order that metabolism might have accustomed itself so far as possible to the unusual conditions.

The nitrogen of the milk was estimated daily; that of the pancreatin tablets was estimated in three samples and the average taken. The eggs were carefully weighed each day, the shells weighed after the eggs were used, and the difference taken as the weight of the egg-albumin and yolk; the nitrogen in the eggs was then calculated from the tables ordinarily given. The fat in the milk was estimated by the Leffmann-Beam process, that of the eggs taken from tables. The total feces were collected daily, acidulated with sulphuric acid, and evaporated to dryness on the water-bath. The total dry and ground feces of the whole period was thoroughly mixed, and five estimations of the nitrogen and three of the fat were made. The nitrogen was estimated by the Kjeldahl process, the fat by extraction in the Soxhlet apparatus. In each case the period of investigation was six days.

CASE I. PATIENT H. NITROGEN.

Nitrogen of Urine.

February 1st	11.160
February 2d	10.504
February 3d	10.5624
February 4th	10.856
February 5th	7.147
February 6th	9.9588
Total	60.1882
Nitrogen in eggs	34.7321
Nitrogen in milk and tablets	13.5396
Total food nitrogen	48.2717
Fecal nitrogen	29.0254
Nitrogen absorbed	18.2463 = 39.88 %

Total nitrogen absorbed (18.2463 grammes) equals 123.039 grammes protein in six days.

Nitrogen absorbed daily equals 3.041 grammes; this equals 19 grammes protein.

Total fecal nitrogen	29.0254
Total urinary nitrogen	60.1882
	89.2136
Total nitrogen absorbed	18.2463
Total loss tissue nitrogen	70.9673

Equals loss of tissue protein 443.535 grammes.

FAT.

Fat in eggs	167.810	
Fat in milk	117.840	
Total fat in food	285.650	
Total fat in feces	246.770	
Total fat absorbed	38.88	= 13.61 %

Total fat absorbed per day 6.48 grammes.

CASE II. PATIENT N. NITROGEN.

February 6th		16.0599
February 7th		15.2105
February 8th		10.2028
February 9th		9.3586
February 10th		13.1022
February 11th		12.7270
Total		76.6610
Nitrogen in eggs	34.0843	
Nitrogen in milk and tablets	14.0307	
Total food nitrogen	48.1150	
Fecal nitrogen	25.261	
Nitrogen absorbed	22.854	= 47.5 %.

Total nitrogen absorbed (22.854 grammes) equals 142.837 grammes protein in six days. Nitrogen absorbed daily equals 3.809 grammes; this equals 23.816 grammes protein.

Total fecal nitrogen	25.261
Total urinary nitrogen	76.661
	101.922
Total nitrogen absorbed	22.854
Total loss tissue nitrogen	79.068

Equals loss of tissue protein 494.175

Fat.

Fat in eggs	164.688	
Fat in milk	120.072	
Total fat in food	284.760	
Total fat in feces	189.50	
Total fat absorbed	95.26	= 33.46 %.

Total fat absorbed per day, 15.87 grammes.

These results correspond fairly well with those obtained in the case previously mentioned; and in these two cases, as well as in the one previously reported, it is quite evident that rectal alimentation was an extremely insufficient method of maintaining nutritive equilibrium, even for a short period. The amounts absorbed in all the cases were far less than the demands of the patients, and the condition of the urinary nitrogen demonstrated that the tissues were suffering largely. The nitrogen in the urine, compared with the nitrogen absorbed, indicates a very marked tissue-loss; and, further, in Case I., as in the case investigated in the previous report, though to a less marked degree, the urinary nitrogen showed the same rapid fall that is exhibited by persons who are actually undergoing starvation.

That the food was insufficient was also clearly shown by the appearance of the patients. The patient of the previous report was, as stated, losing weight and strength so evidently and rapidly that the investigation, which was begun late, had been continued only two days when it was considered necessary to give food by the mouth. Of the subjects of this report, only the second patient had her weight recorded before and after the eighteen days of rectal alimentation. During this time she lost forty-two pounds. The weight of the other patient before rectal alimentation was instituted was not known, but it was evident that she was losing weight rapidly. The figures given show that she absorbed less than the other woman, and it is highly probable, therefore, that she lost a similar amount of weight.

A fact of decided interest in this connection is that both patients persistently stated that the nutritive enemata greatly relieved their hunger. They said, however, that their hunger was much appeased

within a few moments after the enemata were administered. This feeling of relief could, therefore, hardly have been anything but psychic; and a comparison of the patient's own feelings with the figures given for absorption is sufficient to demonstrate the inadequacy of such sensations as a measure of the effect of the alimentation. Some authors insist rather strongly upon the fact that the enemata greatly relieve or entirely do away with any sensation of hunger.

Our figures in three cases, therefore, so far as they are an indication of general conditions, show that, at most, 40 to 50 per cent. of the nitrogenous food and, at most, one-third of the fat are absorbed. These percentage figures, in themselves, do not sound so unsatisfactory. If a fairly large quantity of nitrogenous and fatty food could be given per rectum the absorption of 50 per cent. and 33 per cent., respectively, of these foods would furnish the patients with a very considerable amount of nutriment; and if their metabolic demands were already slight from prolonged disease and consequent prolonged subnutrition, it would serve to maintain them in nutritive equilibrium and, perhaps, cause them to put on tissue. This, however, cannot usually be the case. We are, as a rule, limited strictly to comparatively small quantities of food, because the bowel will not retain more; and if an attempt is made to give larger quantities the percentage of absorption falls, and, indeed, it often becomes impossible to carry out rectal alimentation at all, because the larger quantities frequently cause severe irritation of the bowel.

If the actual calorie value of the food absorbed in our cases be reckoned, it will be found that patient No. 1 absorbed of

	Grammes.	Calories.
Fat	38.88	361.5
Proteid	123.039	467.5
Total equalling		829.0

If the total milk-sugar, reckoned high (at 4.5 per cent.), be considered to have been absorbed and be added to this we gain 442.8 calories. The total possible food calories absorbed by this patient in six days would then be 1271.9. The total food calories absorbed per day would, under these circumstances, equal 211.9. The patient

had a moderately excessive amount of body fat, and may be considered as demanding only about 30 calories per kilo to maintain her nutritive equilibrium; she would then need 1800 to 2000 food calories per day.

In the second case the conditions were not quite so bad. The woman absorbed of

	Grammes.	Calories.
Fat	95.26	885.9
Proteid	142.8	585.6
Total		1471.5

If the total milk-sugar be considered absorbed in this case, also, and reckoned as in the other, we add 442.8 calories and get a total of 1914.3 possible food calories absorbed in six days. Her total calories per day would then be 319. This woman was larger and heavier than the other, and her demands, reckoned at 30 calories per kilo, would be 2000 to 2200 calories per day.

The first patient, therefore, received about one-ninth of the amount of food that would be sufficient to maintain her nutritive equlibrium; the second patient, about one-sixth or one-seventh. Even this, however, as we shall show later, is certainly more than either actually absorbed, owing to the error caused by bacterial decomposition; indeed, it is possible that these amounts are decidedly more than they should be in order to represent the actual absorption. This question will, however, be discussed after referring to the literature.

When our results are compared with the work of others it will be seen that there are notable individual differences, but that, on the whole, the literature indicates that the figures which we obtained for the absorption of protein are not unusually favorable; and there is an almost general agreement that fats are but slightly absorbed, and that their use in rectal enemata provides very little nutrition, and also probably tends to interfere with the absorption of other food, since they undergo decomposition and irritate the bowel. The question of the absorption of carbohydrates will be mentioned later. We made no attempt to determine the actual degree of absorption of carbohydrates in our cases, for reasons that will be noted.

First, as to the absorption of albumin. Voit and Bauer,[2] and Eichhorst,[3] the first experimenters in this line, determined that eggs are practically not absorbed by the large intestine of dogs, unless salt be added to them; but that if salt is added, they are fairly well absorbed.

As to the effect upon human beings, the greatest influence in regard to this question has, undoubtedly, been exerted by Ewald[4] through the report that he published in 1887. It has been generally accepted by that author since then, and by numerous writers who have followed him, that eggs injected per rectum are very well absorbed. Ewald's results, given in graphic form, are very difficult to examine carefully, and are very confusing. The figures themselves have, therefore, largely escaped careful observation. It is, however, worth while to give them some attention. His results, in the first place, are practically those obtained on one patient alone, and that patient certainly showed conditions of absorption that are most unusual; for, if the amount of nitrogen ingested be compared with the quantity given as absorbed, it will be found that the loss of nitrogen in the feces was far below even that which is normal in persons fed by mouth upon readily assimilable food. Indeed, in some of the periods, even when milk in quantities of half a litre was given per rectum (and it is generally recognized that milk is ordinarily not very well absorbed), the excretion of nitrogen per rectum amounted to as little as 0.11 gramme a day, which is less than is found when absolutely no food is administered; in other words, it is less than the amount that is customarily due to the secretions of the bowel wall and to the breaking down of intestinal epithelium. Indeed, in almost all of the periods presented the excretion per rectum was abnormally low. The figures obtained in this case, therefore, cannot be properly accepted, as they have generally been, as indicative of the general results of the use of rectal enemata.

The chief stress is laid by Ewald upon the condition of the urinary nitrogen and the nitrogen balance in his case; and he directs special attention to the fact that the urinary nitrogen was largely increased, in many instances, by the use of rectal enemata, and that a negative balance, or a slightly positive one, was transformed into a very marked nitrogen-retention. He himself notes,

however, that the conditions varied greatly. In some instances the use of egg-enemata caused only an extremely slight nitrogen-retention, and in others the nitrogen-retention rose as high as 17 grammes. The same was true of "peptone" enemata. The author attributes these results to differences in the assimilability of the food used, rather than to its readiness of absorption. The condition of the nitrogen balance varied, however, to an extreme degree when exactly the same enemata were given in different periods, and it seems rather more probable that a large part of the difference in the nitrogen balance was due either to variations in the metabolic processes not dependent upon the food that was being used, or to a possible technical error. The latter suggestion is made upon the basis of the fact that Ewald himself says that the feces in the different periods varied between 177 and 1844.5 grammes. It is certainly impossible, under such circumstances, to be sure that the feces of one period were properly collected in that period, particularly since no way of separating off the feces was used or could well be used under the circumstances.

The value of rectal enemata can evidently not be determined, however, by studying the urinary nitrogen. The most important point is to determine the actual absorption; and in this case, as stated, while the absorption was good it was so good that the results must be considered to be wholly unusual.

Next to Ewald, the most satisfactory results have been obtained by Huber,[5] who insists from his work on human subjects, as did earlier investigators after animal experiments, that egg-enemata are much better absorbed if salt is added to the egg. Huber investigated three persons throughout a number of three-day or four-day periods, during which enemata of simply emulsified eggs and enemata of eggs and salt or of peptonized eggs were given, and these were compared with other periods during which no enemata were administered. His results varied greatly. In the first case the figures which he gives and which refer exclusively to nitrogen show, with simply emulsified eggs, only 11.9 per cent. of absorption; with the same in a later period, 17 per cent.; with eggs and salt, as little as 7.1 per cent. of absorption; in a later period of the same enemata, 49.1 per cent. absorbed; with enemata of peptonized eggs, 63.3

per cent. In this last-mentioned period the amount of nitrogen absorbed per day was slightly more than 3.5 grammes—a very considerable amount, although, of course, much less than was necessary to maintain a normal equilibrium.

In his second and third cases the results were much more satisfactory.

Huber's results also are difficult to understand, in the first series particularly, and to some extent in the third. The first patient showed almost constantly a nitrogen-retention; the third patient showed a nitrogen-retention throughout three of the periods; and yet, in spite of this, and in spite of the apparently very marked increase in the absorption of nitrogen, the urinary nitrogen showed practically no change. Under such circumstances the patient would almost certainly exhibit a marked increase in the excretion of urinary nitrogen; but this did not occur. The fact that it did not is hard to explain, unless there was a technical error; and, again, the evidence of a technical error is, we believe, found by a critical inspection of the figures relating to the feces. In the second case, the daily feces in the period when no enemata were given varied in weight from 152 grammes to 611 grammes, and the nitrogen (of the entire periods) varied from 0.55 gramme to 5.21 grammes. In the third case, when enemata were not given, the weight of the feces ranged from 313 grammes to 2044 grammes, and the fecal nitrogen from 2.55 grammes to 12.88 grammes. During these periods, in each case, the food was exactly the same. It is, of course, possible that absorption did vary as largely as this, but even if it did, it makes the value of the investigation doubtful; and it seems to us that a frank acceptance of probabilities must unquestionably lead to the conclusion that the feces were not properly collected in the periods to which they belonged. The different periods were of only three or four days' duration, and when absorption is being studied for such a brief time, with a period of another kind preceding and following directly after, it is especially essential that some method of marking off the feces belonging to each period be used. This is impracticable in studying rectal alimentation, and hence a wide range of error must be reckoned with. In Huber's second and third cases particularly, in which absorption and metabolism seemed

especially satisfactory, the possible error is so large that it could readily make the figures that he gives indicate directly the contrary of what actually occurred. We grant that the same error was operative in our own work. But it must have been far slighter than in Ewald's or Huber's work, for our subjects had been on the same alimentation for five days before, and no comparison was made with any other periods, while Ewald and Huber kept their subjects on different forms of alimentation only a few days, and included all these days in reckoning results. Any error from this cause that occurred in our work could have been due to only one cause—*i. e.*, retention of feces that should have been expelled during the period of study. In such case absorption was even poorer than our figures indicate.

On the basis of Ewald's and Huber's work there has been rather a general acceptance of the statement that eggs are very readily absorbed from the large bowel. We believe that facts by no means indicate that this is generally the case.

Aldor[6] has claimed also that milk, when given in large quantities and when sodium carbonate is added to it, is well absorbed, and constitutes a better enema than any other as yet proposed. It is difficult, however, to understand his reasons for recommending milk so warmly. His actual results were as follows: In the first period the patient whose absorption was investigated absorbed, at most, 38 per cent. of the protein of the milk and 35 per cent. of the fat: while in the second period he absorbed only 12.6 per cent. of the protein and less than 1.5 per cent. of the fat. These figures are scarcely convincing of the value of large milk-enemata.

Other investigators of the subject have not had as satisfactory results with either eggs, milk, or predigested foods.

Czerny and Lautschenberger,[7] investigating a case of colonic fistula, reached the conclusion that only about 6 grammes of protein were absorbed by the large bowel in a day. Markwald found that "peptones" were irritating to the colon, and that the irritation prevented free absorption; and he also found that egg albumin, with or without salt, was but little absorbed. Plantenga[8] is also referred to as having obtained very unsatisfactory results, but his article could not be secured by us. Kobert and Koch[9] found in a patient with a

fistula at the ileocæcal junction that very little of either eggs or "peptones" was absorbed.

Brandenburg[10] investigated the usefulness of nutrose as a rectal aliment, and found that at most about 40 per cent. was absorbed. He also gave enemata of eggs and milk, and found that of 16.5 grammes of nitrogen 10.36 were not absorbed. He reckoned from this that the absorption of eggs was at most about 50 per cent., and of milk still less.

Strauss[11] confirmed Brandenburg's results as regards nutrose. He states that he also administered eucasin per rectum to a patient with œsophageal fistula. His figures could not be given absolutely, because some of the fecal nitrogen might have come from the previous period; but he thinks that at most 40 per cent. of the eucasin-nitrogen was absorbed.

Plantenga,[12] in a second communication, contributes some investigations concerning the effect of somatose injected into the lower bowel of a dog. He found that only 10.8 per cent. to 24.1 per cent. was absorbed in six different investigations.

Finally, it may be mentioned that Kohlenberger[13] claims that all of Witte's "peptone" was absorbed when injected per rectum. He bases his statement purely upon the fact that lavage after the administration of albumoses per rectum brought forth nothing that gave the biuret reaction. This method is wholly unsatisfactory, as it entirely overlooks both the influence of bacteria and the possible conversion to amido-acids, etc., by digestive ferments.

As to the fats, the story is a much simpler one. Everyone that has worked on the question of the absorption of fat from the rectum has reached unfavorable conclusions, with the exception of Hamburger, whose work was theoretical rather than practical. Munk and Rosenstein,[14] investigating a case of fistula of the thoracic duct, injected fat per rectum, and found that the increase of fat in the chyle indicated an absorption of only 3.7 to 5.5 per cent. Plantenga[8] is referred to as having had similar results by studying the feces. Strauss[11] found that only about 10 per cent. of fat was absorbed. Aldor[6] found an absorption of 33 per cent. of milk fat in one period; while, with the same patient and the same enemata, in another period soon after the first-mentioned one, he found an absorp-

tion of less than 1.5 per cent. Deucher,[15] whose work on this question has been the most extensive of any except that of Hamburger, found that the maximum absorption of fat per day was about 10 grammes, even when circumstances were favorable. The absolute absorption per day which he found varied only from 4.5 grammes to 9.9 grammes. He thinks that there is little value, if any, in giving the enemata frequently or in administering large amounts

Directly contrary to these results are those of Hamburger,[16] who, from his experimental work on animals, considers that the large intestine absorbs quite as much fat as the small intestine, provided the fat is administered in proper emulsion. He says that the use of sodium carbonate or of sodium chloride solution in preparing an emulsion is wholly unsatisfactory, because these salts are soon absorbed, and the emulsion is consequently soon destroyed. He found that a solution of soap (*sapo medicatus*) was well adapted to this purpose. The soap was absorbed, and during the absorption was partially changed into fat, but the emulsion was well maintained, and the fat in the soap emulsion was remarkably well absorbed. As stated, however, these results must be considered to be theoretical rather than practical. The work was carried out under purely experimental conditions, and, further, it is questionable whether a soap-enema would be tolerated by the human bowel. Hamburger's method has not been tested with human beings: while it is worth trying, we must for the present consider that fats are absorbed only in very small amounts when administered per rectum, and, in contradiction of his views, it must be remembered that numerous investigators worked with the best emulsions possible—*i. e.*, milk and egg-yolk.

We turn now to a brief consideration of the question of the carbohydrates. Until recently the general opinion has been that sugars are very quickly and freely absorbed from the large bowel; and that starches are slowly transformed into sugars, and in large part absorbed. Strauss,[11] indeed, has gone so far as to say that he has maintained patients in good condition, for one, two, or nearly three months, with enemata consisting very largely of sugar. The great difficulty with the use of sugar, in the experience of most clinicians, has been that it tends to cause marked irritation of the bowel, and soon interferes with the use of enemata. Strauss claims that 40 or 50 grammes of glucose can be used in an enema, and the use of these

enemata continued for a month or more without producing, in a large proportion of the cases, any irritation. He seems to stand nearly alone in this view.

The work of investigators on the absorption of carbohydrates has been done almost solely by injecting carbohydrates into the bowel, and determining that little if any sugar or starch is subsequently found in the bowel-movement. It is difficult to understand why such a method of work has been considered satisfactory, as it is certainly possible for a large portion of the sugar, and even of the starch, to have been broken up by bacteria and to have been passed as products of bacterial action or absorbed as such, and thus to have furnished little or no nutriment to the patient. This fact has recently been strongly insisted upon by Reach,[17] and very important testimony that this probably often does occur was offered by him. He administered various sugars by mouth, and at other times the same amounts and kinds per rectum, and determined their effect upon the respiratory quotient, considering this method to be a direct and positive means of determining whether the carbohydrates used had had any influence upon the actual tissue-processes. He found the expected effect upon the respiratory quotient when the carbohydrates were given by the mouth. When administered per rectum, he found little or no influence upon the respiratory quotient. He insists that carbohydrates in general are probably but little absorbed as such from the large bowel, and that the previous teaching has been the result of imperfect methods of study.

It was with the same thought in mind that we undertook in our cases a determination of the urinary sulphates for several days during the course of the absorption experiments. The figures obtained were as follows:

Case I.

February 2d.	Preformed SO_3	1.091
	Conjugate "	0.175
	Ratio 1 to 6.2.	
February 3d.	Preformed SO_3	1.227
	Conjugate "	0.144
	Ratio 1 to 8.5.	
February 4th.	Preformed SO_3	0.806
	Conjugate "	0.162
	Ratio 1 to 4.9.	

Case II.

February 7th.	Preformed SO_3	1.8838
	Conjugate "	0.4819
	Ratio 1 to 3.9.	
February 8th.	Preformed SO_3	2.0173
	Conjugate "	0.5536
	Ratio 1 to 3.6.	
February 9th.	Preformed SO_3	1.3854
	Conjugate "	0.4197
	Ratio 1 to 3.3.	
February 10th.	Preformed SO_3	1.5549
	Conjugate "	0.6555
	Ratio 1 to 2.3.	

The ratio of the preformed to the conjugate sulphates is of little consequence, particularly when so little food is being absorbed as in these cases. The absolute figures for the conjugate sulphates are, however, important. They show in Case I. about normal values; or, more correctly, if it be remembered that the patient was taking very little food, they show that she was excreting a somewhat excessive amount of the conjugate sulphates. Case II., however, was excreting an amount that would be from two to three times the normal, even in a person on a full, ordinary diet. It is, therefore, probable that in Case I. an abnormal amount of putrefaction was taking place in the intestine, and it is certain that in Case II. an exceptionally high degree of putrefaction was present.

These figures are of interest and, we think, of importance if they are compared with the results of the study of absorption in the same cases. Case I., with but moderate evidences of putrefaction, was absorbing badly. Case II., with very active evidences of putrefaction, was absorbing considerably better. These results, particularly when considered in connection with the work of Reach, make it seem highly probable that the putrefactive processes going on in the intestine when rectal alimentation is used are frequently, perhaps always, excessive, and that a certain part of what has previously been considered to be absorption of food has been bacterial decomposition of food. In the case of the fats under such circumstances a very considerable portion might be absorbed as either non-nutritious or actually toxic substances, and another portion, also con-

siderable, might be excreted in the bowel movements in a form which would not appear in the ether extract. The amount of fat found in the feces, as compared with the amount administered, would then be altogether too favorable an indicator of absorption.

In the case of the proteid, since absorption is reckoned from the nitrogen, the influence upon figures obtained for absorption would be comparatively slight. It is possible, however, that the absorption would seem too great in this case also, as some of the nitrogen might, as the result of bacterial decomposition, be passed as ammonia, etc., and thus be lost. This portion is probably of small moment; but, on the other hand, it is wholly probable that a considerable portion of the nitrogen that we have previously recognized as absorbed nutriment has really been absorbed as bacterial products; most of these would be of little or no value in nutrition, and many are to some extent toxic.

If, then, the general results of various investigators be collated, it will be seen that occasionally, as in Ewald's case and in a portion of the different series described by Huber, absorption of albumins seems to be so satisfactory that a very large percentage of what is administered actually furnishes nutriment; but Ewald's case must be considered an extremely exceptional one, and Huber's work is only partially favorable, and is subject to criticism. The work of other investigators, which is, collectively, decidedly more extensive than that of Ewald and Huber, indicates that egg albumin, whether given plain or predigested, with or without salt, is, in most instances, not more than half absorbed, and frequently much less than this; that preparations, such as somatose, nutrose, and eucasin are still more imperfectly absorbed; and that, as a rule, albumoses (so-called peptones) are irritating to the bowel if given in such quantity as to furnish any considerable amount of nutriment, and are also not usually more satisfactorily absorbed than the other substances mentioned.

As to the fats, there is pretty general agreement with the statement of Deucher that the limit of absorption in one day is about 10 grammes. In exceptional instances, as in one of our cases, decidedly more than this is apparently absorbed. The question of the carbohydrates is as yet unsettled, but Reach's work demonstrates

that too much value has been placed upon this class of food, and that it is probable that a large portion of even the comparatively small amounts that can be administered per rectum is not absorbed.

If all these factors be taken into consideration it will be found that under ordinary circumstances the bowel can scarcely be expected to absorb an amount of food in twenty-four hours equal to more than six or seven hundred calories, and that frequently the amount is very decidedly below this. If, further, the factor of bacterial decomposition, which makes the results seem more favorable than they actually are, be considered, it must be recognized that even the amount mentioned is more than is really provided for the tissue needs. Since this is the case, it is perfectly evident that unless circumstances are exceptionally favorable the use of rectal enemata furnishes far less food than is sufficient to maintain the patient in nutritive equilibrium, and that, indeed, in very many instances the patient is, when nourished exclusively per rectum, relatively little removed from a condition of simple starvation.

Granting the correctness of this conclusion, there are certain facts which must be explained. It is frequently stated, on the basis of clinical observation, that patients can be maintained for a short, sometimes for a long, period in a good condition of nutrition upon exclusive rectal alimentation. The reasons that such statements are made are several: In the first place, in the large majority of cases they are made merely as the result of superficial observation and on the basis of the patient's statement that the enemata relieve hunger. They are often unaccompanied even by the weighing of the patient or by inspection of the amounts passed per rectum; and in such instances they have no real scientific value.

But there is one real factor that is, as a rule, overlooked. In the article previously mentioned one of us insisted upon this factor as being of much importance, and it is especially emphasized by Strauss as being perhaps the matter of greatest importance in the use of rectal enemata. This is the absorption of water from the enemata. A maintenance of the weight exhibited at the beginning of the use of enemata, and even an increase in weight over a considerable period, may unquestionably, in a good many cases in which rectal enemata are indicated, be due not to the absorption of food,

but to the absorption of water. Patients who demand this form of alimentation, as, for instance, those with pyloric or œsophageal obstruction, intractable vomiting, and the like, are now generally recognized to be frequently suffering from lack of fluids quite as much as from lack of food; often even more. In such a case the administration of nutritive enemata or of fluids alone meets one of the most important indications in the case by furnishing fluids to the tissues; this relieves the patient's general symptoms very largely, and not infrequently causes him to put on a considerable amount of weight. In such cases, however, it must be recognized that the improvement is not due to the food, but to the water.

Granting, however, that the results that are considered extremely favorable are at times due to mere superficial observation, and at times to absorption of water rather than of food, it must still be recognized that a number of clinicians whose experience is wide and whose observation is accurate state that they have occasionally maintained patients in fairly good nutritive equilibrium for quite long periods with the exclusive use of rectal enemata. An explanation for such statements must be offered, and an explanation quite in consonance with what we have previously said in this article can be offered if we consider some of the more recent views concerning the variations in the absolute food-demands of the system under varying circumstances. It was taught for years, on the basis of Voit's work, that a normal person at rest—as these cases, of course, practically always are—demands about 1.5 grammes of albumin to each kilo of body-weight; and that at the same time he demands that the total calorie value of his food should be about 40 per kilo, in order that he should not lose tissue. If this were absolutely the case under all circumstances we should necessarily be driven to the conclusion that in studies of the nutritive value of rectal enemata, either the results of investigators must be entirely wrong or the observations of those clinicians who claim that a nutritive balance is sometimes maintained must be wholly inaccurate.

Voit, however, modified his own statement later, and showed that about two-fifths of the amount mentioned was sufficient to maintain a nitrogen equilibrium; and a series of other investigations, among which those of Rubner, Hirschfeld, Klemperer, Kumagawa, and

Breisacher are prominent, demonstrated clearly that a tissue loss can be avoided if the caloric value of the food be kept high, when as little as 0.9 gramme to 0.4 gramme of nitrogen per kilo is being taken.

More recently Siven and Albu have shown still more striking results, persons in normal condition maintaining a nutritive balance on an equally small amount of nitrogen when the calories were reduced to the normal point or even below. Perhaps the most striking instance in which this has been shown by figures is the case recently reported by Albu.[18]

The person investigated was a female vegetarian, who for six years had lived exclusively upon a diet which had varied little from that which she was taking at the time of the investigation. It then consisted of 225 grammes of carbohydrate, 36.44 grammes of fat, and only 5.46 grammes of nitrogen, the woman weighing 37.5 kilos. The nitrogen-metabolism was determined while this diet was being continued, and it was found that the woman was maintaining a nitrogen balance, and that her weight also remained practically constant. Her nitrogen absorption per day was only 3.30 grammes, which was equal to only 0.56 grammes of albumin per kilo. At the same time her total caloric intake was but 33.8 per kilo. In spite of this the woman, even while doing moderately taxing intellectual work, maintained a nutritive balance, as was stated.

A striking collective statement of this question appeared recently in an interesting paper by Bernert and Steyskal. The authors direct special attention to the fact that the minimum food intake consistent with the maintenance of a nutritive equilibrium has generally been placed far too high. They believe that it has been proved that it is possible to reduce the intake to 0.48 gramme of albumin per kilo, and at the same time to have the total caloric value of the food as low as normal, probably even lower, and yet nutritive equilibrium may be maintained. They, however, emphasize the fact that in order to accomplish this it is usually necessary that the patient should have gradually accustomed himself to a reduction of his food intake. It is certain that if the food is suddenly reduced from a large down to a very small amount the patient will, for the time being, be thrown into a condition of practical starvation; if, however, it is gradually

reduced he will gradually reduce his metabolic demands, and this can be carried down to a strikingly low point.

This is a brief explanation of the fact that patients may occasionally be maintained at a nutritive equilibrium with the use of rectal enemata, even though rectal enemata, at best and even if entirely absorbed, cannot provide a normal amount of food. The fact that man can reduce his absolute demands to so low a point would at first seem to indicate that we have been wrong in insisting that there is but a limited value in the use of rectal enemata. It does demonstrate that they have importance, for if a patient can be maintained in nutritive equilibrium, even though the point at which equilibrium is reached has been largely reduced by prolonged subnutrition, a very decided gain over any condition in which there is tissue loss has been made. It should, however, be very definitely realized, on the other hand, that a mere maintenance of equilibrium at the minimal point, or at a point approaching the minimum, is far from being an ideal condition, and is really only a makeshift. The reduction of food to the lowest point consistent with the maintenance of an equilibrium means that the patient is being put into a condition of subnutrition; and the mere fact that he does not lose weight under such circumstances does not by any means indicate that he is being normally nourished. Even though we have learned that a balance can be maintained on far less food than Voit's figures indicated, we must at the same time hold to the fact that his figures do indicate the amount that a normal person, living normally, takes. Hence, while a reduction of the quantity of food very considerably below this point, if gradually undertaken, may be consistent with the maintenance of a constant weight and of apparently fairly good health, such reduction must always be considered to mean a condition of subnutrition, and the more marked the reduction the more severe the subnutrition.

When this view is applied to the question of the use of rectal enemata we must realize that even if the utmost limit of success with rectal enemata be attained and the patient be kept from losing weight, we are at best not nourishing him properly. If as much success as this be obtained, and it is in the case at hand merely a question of inability to take food by the mouth for a limited period,

it is, of course, proper to continue rectal alimentation as long as needed. We believe, however, that such a degree of success is but rarely attained. If, on the other hand, it is a question of attempting to maintain a patient's nutrition and to improve it in preparation for operation, in such cases as pyloric and œsophageal obstruction, it is perfectly evident that the limits of success are very narrow; in practically all cases it is impossible to improve nutrition in this way to any notable extent, and the chances are large that the patient will lose decidedly rather than gain. If we hope to do any good by operative procedures we should not delay long with rectal alimentation, but should intervene as soon as practicable. In other cases in which food by the mouth is withheld because of the danger of hemorrhage, etc., we must realize that the patient is usually being partially starved, and if a critical occasion arises we must consider well the relative importance of partial starvation and of the dangers associated with the administration of food.

In conclusion, we would say, briefly:

Rectal alimentation in exceptional cases provides enough food to the tissues to prevent tissue loss. Even in such favorable cases the best that can be done is to maintain the patient in a condition of decided subnutrition.

Usually food administered per rectum is very imperfectly absorbed, and rectal enemata, as a rule, supply only a very small part of the amount of food necessary in order to maintain a nutritive equilibrium.

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DISCUSSION.

DR. J. ALISON SCOTT: I would like to ask Dr. Edsall if in the course of his investigations he observed that one variety of rectal alimentation is more beneficial than others, and if there are any of the various nutritive enemata that he is accustomed to use which furnish better results than predigested milk, egg, and small amounts of whiskey.

DR. H. A. HARE: I would like to ask Dr. Edsall what he has found to be the difference in absorption in the various degrees of predigestion of food-stuffs. Probably every enema differs in the degree to which the peptonizing process is carried out. Therefore, I would imagine there was a very great difference in the possibilities of dialysis. I can understand that when the peptonizing process is carried out to a degree which equals that of the peptonization of ordinary alimentation carried on under normal circumstances a much larger quantity of food-stuffs would be absorbed than when the peptonizing process has been imperfectly carried on. The degree of peptonization must have an influence upon how much nutriment the patient gets from the enema.

DR. J. M. ANDERS: I have long felt that rectal alimentation was but partial feeding. In cases of gastric ulcer I have been in the habit of combining rectal feeding with partial feeding by the stomach. At a recent meeting of the German Congress of Physicians it was agreed that rectal alimentation was at best but subalimentation, and that all of the food thus employed was by no means absorbed. This bears out the conclusions reached by Dr. Edsall.

DR. H. A. HARE: I would like to ask Dr. Edsall whether the comparison of calories was made between the number the patient absorbed from the food and the total number she needed. I think the proper comparison is the comparison between the number absorbed and those contained in the food-stuff injected rather than the difference between the absorbed and the total amount which the patient required in the day. This method may have been the one used by Dr. Edsall.

DR. EDSALL closes: In reply to Dr. Scott, I would say that there have been a number of investigations carried on by several authors concerning the kind of food that is most satisfactory in rectal alimentation. The recommendations differ. It is, however, an established fact that fats should be given in the form of a natural emulsion, as they are found in milk and eggs; and that the protein that is best absorbed is egg-albumin and other albumins that are in a form of fine division or of good solution. Ordinarily, I think it has been found that the best enema contains milk and eggs; and that certain artificial preparations, such as nutrose, may advisedly be added. There is a distinct difference of opinion as to the advisability of adding a small amount of alcohol. There can, however, be but little difference of

opinion as to the question of adding table salt. There seems to be no doubt that enemata are much better absorbed if salt sufficient to make the mixture contains about the physiological proportion of sodium chloride be added.

In answer to the remarks of Drs. Hare and Anders, I would say that I had no intention of indicating that it is generally taught that rectal alimentation is sufficient to maintain life at the highest standard; but I did mean to say that some prominent writers abroad, and particularly several in this country, have recently practically made such an assertion. Such statements cannot, I think, be supported; and even the common teaching that a very considerable proportion of the necessary amount of food can be administered in this way is, ordinarily at least, too generous toward rectal alimentation.

As to the question of the calculation of the proportion of calories absorbed, I compared the amount of calories absorbed with the whole amount that the patient actually needed—not for the purpose of casting further slurs upon rectal alimentation, but with the object of showing what can be accomplished with this method of feeding as compared with the amount demanded in order to maintain nutrition.

As to the effect of the extent of peptonization of the food upon the amount absorbed, satisfactory studies of the kind suggested by Dr. Hare have not been made. I think, however, that it would not be possible to carry the peptonization to a very advanced degree without producing decided irritation of the bowel by the enemata. Dr. Miller and I have been working for a considerable time past, trying to provide a more satisfactory method of rectal alimentation based upon some of the more recent work concerning digestion. As yet, however, our efforts have been unavailing.

PRESENTATION OF A PATIENT ONE YEAR AFTER DIVISION OF THE SENSORY ROOT OF THE GASSERIAN GANGLION FOR THE RELIEF OF TIC DOULOUREUX; NO RECURRENCE.

By CHARLES H. FRAZIER, M.D.

[Read October 1, 1902.]

I EXHIBIT this patient before the College to-night because I feel it is due Dr. Spiller and incumbent upon myself to make public the records of this case one year after the operation was performed. In 1898 the idea occurred to Dr. Spiller that this operation might be substituted for those operations that require entire extirpation of the ganglion for the relief of this condition. In June, 1901, I reported before the Surgical Section of the American Medical Association the experimental results obtained by Dr. Spiller and myself in operations upon lower animals, with a view of determining whether regeneration of this root would occur after its division. Last winter I presented a report to the Academy of Surgery, relating my experience with the first operation performed upon the human subject. I now take pleasure in exhibiting the patient before the College one year after the operation has been performed, with the idea of presenting substantiated evidence or testimony to the effect that the operation has been permanent in its effects.

The case is of twofold interest: first, from the standpoint of the neuropathologist, and second, from that of the practical surgeon. From the standpoint of the neuropathologist it is of interest because it furnishes evidence or testimony in favor of the theory that regeneration of the sensory nerve roots of the central nervous system will not occur in man. From the standpoint of the surgeon it is of interest in that it has demonstrated the feasibility of the operation, and, furthermore, the permanency of its effect. In the article which Dr. Spiller and I wrote upon this case about a year ago I described quite fully the technique, and attempted to prove that this operation was simpler in its execution than operations requiring for their

success extirpation of the entire ganglion. I firmly believe that it is easier of execution, that it ought to be attended by a lower mortality, and that one runs less risk of injury to the important structures adjacent to the Gasserian ganglion.

This new operation is founded upon substantial evidence. We have developed the idea in a logical way, beginning with the experimental work upon the lower animals, followed by a painstaking pathological study of specimens obtained in the course of the experiments, and finally by an elaboration of the technique and its execution upon the human subject. There remains to be demonstrated whether the operation is to be permanent in its results; once this point is settled we can hope for the indorsement of the operation by the profession at large.

DISCUSSION.

Dr. William G. Spiller: The removal of the Gasserian ganglion is an exceedingly dangerous operation. The mortality given by Tiffany is 22.2 per cent., and it is possible that this does not represent the full mortality, as many fatal cases are probably not reported. In the hope of obtaining some method by which the dauger of operation on the fifth nerve within the cranium would be lessened, I proposed to Dr. Frazier that he should cut the sensory root. Before we attempt to cut the sensory root, however, we should feel convinced that the evidence at hand justifies this procedure.

The opinion of most neuropathologists is that regeneration of the central nervous system does not occur. There has been no satisfactory explanation of this until recently. The investigations of Bethe throw some light on the subject. He showed that the regeneration of peripheral nerves occurs from the nuclei of the sheaths of Schwann, and his statements have been confirmed by the careful investigations of Ballance. Inasmuch as the nerve fibres of the central nervous system possess no sheaths of Schwann, we can understand that regeneration is not likely to occur. Dr. Frazier has cut the sensory root near the entrance of that root into the pons, at a part where the sheaths of Schwann cease. There has been no return of function one year after the operation in the motor or sensory distribution of the trigeminal. It might be said by someone that one year is not a sufficiently long period, and that after resections of the peripheral nerves recurrence of the pain, with restoration of the nerves, has occurred after one year. In reply, I would say that I think it is doubtful that *all* function has remained absent in the distribution of the resected nerves during a period of one year, and that then pain has recurred. In cases in which regeneration of the peripheral nerves has occurred after resection the old course of the nerve has remained, and the surrounding tissues have favored the outgrowth of the

new nerve fibres. In the case operated on by Dr. Frazier the sensory root has probably retracted from the pons, and it is not likely that new nerve fibres—if they were formed—could cross the subdural space and penetrate through the dense transverse fibres of the middle cerebellar peduncle and the longitudinal fibres of the pyramidal tract and form a connection with the sensory nucleus of the trigeminal nerve situated deep within the pons. I feel much encouraged by the results of the operation in this case.

Dr. William J. Taylor: I have had a large experience in assisting at operations upon the Gasserian ganglion, and I consider it one of, if not, the most formidable operations in surgery, and one of extreme danger to life. If this operation which Dr. Spiller has proposed accomplishes the results, as it certainly seems to have done in this case, it is a distinct gain to us in every possible way. Since Drs. Frazier and Spiller read their papers last year I have not had an opportunity of trying the operation. The question is as to the difficulty in technique; but this, of course, can be overcome by experience and practice. Any method that will relieve pain without the very dangerous operation of removing the ganglion itself I think should be tried until it is proven to be unsatisfactory.

Dr. Frazier closes: If only for emphasis' sake, let me repeat what I have already said, namely, that this operation is much simpler of execution than any other requiring for its completion extirpation of the ganglion. We all know that hemorrhage, the most trying and annoying feature of extirpation of the ganglion, is most aggravated when one begins to separate the ganglion from its underlying sheath; this is undoubtedly the most difficult step of the operation. The exposure of the ganglion is comparatively simple; when the operation consists in a division of the sensory root it is practically complete when the exposure has been effected, so that one operation is complete before the most difficult step in the other is approached. The actual division of the root, the final step of my operation, is effected by picking the root up in an instrument especially constructed for the purpose and dividing it with scissors. Dr. Spiller made a suggestion which ought to be followed out in future cases—namely, that a section of the sensory root had better be removed in order to further guard against the possibility of regeneration. While simple division of the nerve seems to have had, in the case I have just exhibited, perfect results, I shall certainly adopt Dr. Spiller's suggestion in the future as being an additional safeguard against recurrence.

HODGKIN'S DISEASE.

With the Report of a Case.

By THOMAS C. ELY, A.M., M.D.

[Read October 1, 1902.]

Devotees of medical literature are prone to worship at the shrine then most popular, which may account for the mass of literature, particularly of late, regarding "Hodgkin's disease."

Again, in proportion to the difficulties of solving a problem, the number of solutions are apt to be numerous, and the etiology of this disease seems quite as obscure and puzzling as when Hodgkin's original paper first appeared.

Modern histology and pathology can add little to the original observation made by Hodgkin, which gives us the first classical clinical picture of this disease.

Synonyms. Some confusion of the subject is apparent in the literature; in the unusual number of names ascribed to Hodgkin's disease I have found some fifteen synonyms. The condition has been variously known as:

1. Hodgkin's disease (after the great morbid anatomist of Guy's Hospital).
2. Pseudoleukemia (Wunderlich).
3. Lymphadenosis.
4. Lymphadenoma.
5. Malignant lymphoma (Billroth), from its invariably fatal termination.
6. Adenie (Trousseau).
7. Lymphadénie (Ranvier).

8. Anæmia lymphatica (Wilks).

9. Recurrent (Rückfall) fever or Ebstein's disease.

10. Lymphatic tuberculosis (Sternberg's disease). (Musser agrees with Sternberg that the pathological condition is one of lymphatic tuberculosis.)

11. Lymphosarcoma (Virchow). (Ehrlich and Lazarus agree with Virchow regarding the condition of lymphosarcoma.)

12. Adenoid disease (Southey).

13. Lymphatic cachexia (Mursick).

14. Desmoid carcinoma (Wagner). Confusion is particularly apparent in the nomenclature and classifications, especially in the following five forms of disease:

1. Pseudoleukemia.

2. Leukæmia (even the splenic and medullary forms, but especially the so-called lymphatic variety, the morbid anatomy and pathology being apparently quite the same, except the number of leucocytes present in the blood).

3. Lymphosarcoma.

4. Pseudoleukæmia infantum, or von Jaksch's disease.

5. Lymphatic tuberculosis, particularly the hyperplastic tubercular conditions.

The functions of the leucocytes, as related to their absence in large numbers in Hodgkin's disease, and their abundant presence in leukæmia cases and cases in which the former disease is admitted to verge into the latter, and *vice versa*, must remain problems for future solution. They certainly add to the confusion.

Whether some of the above diseases will be proved to be identical by the discovery of their etiology, which is still unknown, remains to be seen. It is at least to be hoped by the busy practitioner that soon a more simple nomenclature and classification may be adopted.

History. The earliest description of the general enlargement of the lymph glands, together with the presence of nodules in the spleen, was given by Malpighi in 1669; but, apparently, he did not consider that the combination of these two morbid conditions constituted a definite disease. Craigie (*Pathological Anatomy*, 1828; "Diseases of Glands," p. 250) defined the anatomical char-

acters of the glandular enlargements and pointed out how they differed from those of scrofulous enlargement and from cancer of the glands.

To Dr. Hodgkin rightly belongs the credit of having first described and published, in 1832, the main features of the disease which now bears his name.

Velpeau, in 1839, described the enlargement of the lymphatic glands which was not associated with scrofulæ.

In 1856 Sir Samuel Wilks drew attention to some cases and to their similarity to those described by Hodgkin twenty-four years before.

In the same year Bonfils also described a case. In 1858 Billroth described the structure of the enlarged glands, and Wunderlich published two cases.

In 1859 further contributions were made on the subject by Paxy and by Cossy. Virchow gave a short description of the disease in 1864. In 1865 Cornil collected the cases which had already been observed, and recorded two others. The same year Trousseau devoted a chapter in his *Clinique Médicale* to a description of the disease, to which he gave the name of adénie.

In 1866 Wunderlich gave the first thorough account of the disease in German. In 1870 Murchison (*Transactions of the Pathological Society of London*, 1870, vol. xxi. p. 322) reported a case, in a child of six, occurring ten months after whooping-cough.

Eustace Smith (*Diseases of Children*, 1884, p. 220) reports an undoubted case in an infant of eight months.

In 1898 Sternberg reported fifteen cases of this disease, which he believed to be a lymphatic tuberculosis.

In 1902 Musser called attention to the peculiar recurrent type of fever noted in these cases.

Dr. Hodgkin's original paper appeared in the seventeenth volume of the *Medico-Chirurgical Transactions*, published by the Medical and Chirurgical Society of London. The paper was read January 10 and 24, 1832, under the title "On Some Morbid Appearances of the Absorbent Glands and Spleen."

He says in part: "The morbid alterations of structure which I am about to describe are probably familiar to many practical morbid

anatomists, since they can scarcely have failed to have fallen under their observation in the course of cadaveric inspection. They have not, as far as I am aware, been made the subject of special attention, on which account I am induced to bring forward a few cases in which they have occurred to myself."

He then reports six cases: one in a boy, aged nine years, who had slept with a brother who had died of phthisis some time before. Case II. was in a boy, aged ten years; Case III. in a man, aged thirty years; Cases IV., V., and VI. in males about the age of fifty. He details the history of each of these cases, and then goes on to state that it may be observed that, notwithstanding some differences in structure to be noticed hereafter, all of these cases agree in the remarkable enlargement of the absorbent glands accompanying the larger arteries, namely, the glandular concactinæ in the neck, the axillary and inguinal glands, and those accompanying the aorta in the thorax and abdomen. The enlargement of the glands appeared to be a primitive affection of these bodies rather than the result of an irritation propagated to them from some ulcerated surface or other inflamed texture through the medium of their afferent vessels.

Unless the word inflammation be allowed to have a more indefinite and loose meaning than is generally assigned to it, this affection of the glands can scarcely be attributed to that cause, since it is unattended by pain, heat, and other ordinary symptoms of inflammation, and is not necessarily accompanied by any alteration in the cellular or other surrounding structures, and does not show any disposition to go on to the production of pus or any other acknowledged product of inflammation.

This enlargement in nearly all cases consists of a pretty uniform texture throughout, and this rather to be the consequence of a general increase of every part of the gland than of a new structure developed within it, and pushing the original structure aside, as when ordinary tuberculous matter is deposited in these bodies.

Another circumstance which has arrested my attention in conjunction with this affection is the state of the spleen, which, with one exception, has been found to be more or less diseased, in some thickly pervaded with defined bodies of various sizes, and in structure resembling that of the diseased glands.

In one instance it may be remarked that, although the glandular enlargement had advanced very far, the depositions in the spleen were extremely minute, assuming the appearance of miliary tubercles. It will be seen by this description that Hodgkin had in mind the possible tuberculous nature of the disease, and it is quite evident that two of his reported cases were tuberculous.

The following are a few cases, found in literature, which seem to point to a tuberculous origin of the disease:

E. G. Wood (*Medical and Surgical Bulletin of Nashville*, 1900, lv. p. 385–392) reports four cases of Hodgkin's disease: man, aged thirty-nine years; girl, aged fourteen years; woman, aged thirty years, and a boy, aged six years; in the latter case the child was well until two years ago. His grandfather, two aunts, and one uncle on the paternal side died of phthisis; two years ago he had an attack of tonsillitis, which was followed by enlargement of the glands behind the angle of the jaw on the left side; they slowly increased in size and others became affected. In ten months the glands of the left axilla were enlarged, six months later the glands on the right side of the neck, axilla, and groin were involved, and finally a tumor in the left side of the abdomen was noticed; these glands have increased in size for several months; he has had irregular febrile attacks, 100° to 102°, lasting for three to four days and passing off for a week, to return again. The child was still living at the time of the report. The spleen in this case was much enlarged, and blood count showed 2,238,000 red blood corpuscles, no leucocytosis.

Dr. Finlayson (*Glasgow Medical Journal*, 1900, liii. p. 382) reports a case in a man, aged thirty-nine years, which began first with swelling in the left groin; loss of flesh and weakness gradually made their appearance; history of tuberculosis on father's side of family; patient also had a son who died of tuberculosis, and at the postmortem the patient was found to have an old tuberculous nodule in the apex of the right lung.

Examination showed the neck, axilla, and groin on either side to be the seat of masses of enlarged glands. Blood count: red blood corpuscles, 4,240,000; white blood corpuscles, 6000; temperature 101.5° to 103° F. for seven or eight days, then it was normal for

Case of Hodgkin's Disease.

seven days, then another spurt of fever for ten days; no enlargement of spleen. The patient was put on arsenic and iron, and improved for a short while, but finally succumbed. At the autopsy, masses of enlarged glands were found in the mediastinum and along the mesentery, even extending along the spermatic cord. This was evidently a case of tuberculosis.

DEFINITION. The disease may be described as a progressive anæmia without increase in the number of leucocytes, but in other respects resembling leukæmia. In both instances we have the same progressive hyperplasia of the lymphatic glands. The enlargement of the glands is due to an overgrowth of the adenoid tissue, which in some cases becomes largely converted into fibrous tissue; we also have lymphatic foci in the liver, the spleen, and the glandular organs in all parts of the body. In the blood the red corpuscles may be diminished in number and deficient in hæmoglobin, while in some cases the leucocytes may be increased.

With no discoverable anatomical differences, with identical clinical features, with quite identical pathological changes in the bone-marrow, spleen, and lymphatic glands, the one has been regarded as an aleukæmic stage of the other; lymphoid infiltration of the liver, kidneys, lungs, heart, and other tissues may occur in both instances.

Strümpell says: "Similarity of symptoms in their general course, in the organic changes produced, renders it impossible to draw any sharp dividing lines, and, even in the blood changes, pseudoleukæmia" may merge into genuine leukæmia (*Text-book of Medicine*, 1900).

Pathology. Occasionally the glands are hard and firm, but in most cases they are soft and elastic. In the beginning the glands are isolated, but later they fuse, and may form large masses, and, in the neck and mediastinum, may cause dyspnœa from pressure. On section the tumor has a grayish-white appearance and exudes an opaque fluid which contains lymphocytes; very rarely the glands will be found to be caseous. The tonsils, œsophagus, stomach, and intestines may present ulcerated nodules, originating in the follicular glands. The glands most often affected in the order of frequency are cervical, axillary, inguinal, retroperitoneal, bronchial, mediastinal, and mesenteric.

Gowers reports one case in which the abdominal and pelvic glands weighed eight pounds. In 75 per cent. of cases collected by Gowers, the spleen was enlarged, but the enlargement is not nearly so great as in leukæmia.

Course and Duration. In acute cases the patient rapidly becomes worse. In chronic cases the disease may remain stationary for some time; the duration varies from five to six weeks in acute cases to several years in the chronic form. Gowers gives the following table of fifty fatal cases: Less than one year in eighteen cases; between one year and two years in fifteen cases; between two and three years in six cases; between three and four years in six cases; between four and five years in three cases; over five years in one case.

Symptoms. The most important is the enlargement of the glands; anæmia, enlargement of the spleen, rise of temperature, progressive loss of strength, and emaciation; enlargement of the superficial glands is the most frequent of the early symptoms, in more than one-half it is the first. If the deep-seated glands, such as the mediastinal or retroperitoneal, enlarge first, the diagnosis is necessarily very difficult, and we then may have *pressure symptoms* as the first sign. The cervical glands usually enlarge first, singly at first, but later they may coalesce and form large masses; the larynx may be displaced laterally, or the trachea may be narrowed from pressure, causing dyspnœa, or we may get difficulty in swallowing from pressure on the œsophagus; we may have pain from pressure on the sensory nerves, and from lymphadenoma in the stomach and intestines you may get nausea, vomiting, and diarrhœa. The spleen is frequently enlarged, but this is not an early symptom and cannot be detected until after the glandular enlargement; it never reaches the large size that we get in splenic leukæmia; it is frequently irregular, owing to the nodules of the adenoid tissue.

Blood. Anæmia may be profound, is a common symptom, appears early, and in consequence of the anæmia we get weariness, lack of energy, œdema of the feet, etc.

In many cases there are 50 to 60 per cent. of the normal number of red corpuscles, while in some there are as few as 25 per cent.; sometimes we get poikilocytosis. In the majority of cases there is

no excess of leucocytes in the blood. Gowers found that out of sixty-four cases there was no leucocytosis in thirty-nine, although in 25 per cent. there was some excess of white corpuscles; if there is leucocytosis, it is usually due to an increase in the number of lymphocytes. As a consequence of the anæmia there may be a fatty degeneration of the heart, with weak and irregular pulse.

Temperature. Gowers found that fever was present as a symptom in two-thirds of the cases in which the temperature was taken; it is more frequent in the acute than in the chronic cases, and occurs in nearly all of the patients under twenty years of age. Gowers describes three modes of the pyrexia: (1) The temperature is continuously raised from two to five degrees above the normal and only varies a degree or a degree and a half in the twenty-four hours; (2) there are periods of several days of high fever alternating with periods of normal temperature; (3) marked daily variation, 101° to 103°, in the evening falling to 100° or normal in the morning. Convulsion and coma, from impoverishment of the blood, are noted in children.

Etiology. Tubercuiosis is the only disease which seems to predispose to it. It is much more common in males than in females. It has been noted that nasal catarrh, decayed teeth, inflamed tonsils, discharge from the ear, eczema, or some local irritation might play a causative part. In pediatric practice perhaps no lesion is more common than enlargement of the lymphatic glands, particularly of the cervical group. The original cause, no doubt, lies always in the skin or mucous surfaces, but is often unnoticed, the first lesion being the adenitis. It seems, undoubtedly, an infection, and pyogenic germs of whatever type may be absorbed from the tonsil or any one of the many avenues of entrance.

The disease is not common before the twentieth year, and most common between the twentieth and fortieth years. The exceeding rarity of Hodgkin's disease in children, as remarked by Holt, renders the present case interesting, occurring in a child, aged three years, the process beginning at the age of two years.

M. L., German, in the third year, had a severe attack of whooping-cough, continuing for four months, from November, 1900, to March, 1901. Both parents are living and in good health. The only point of interest in the family history is the fact that both the father's mother and the mother's

mother died of pulmonary tuberculosis, and both at the age of forty. Grandfather and three uncles on the mother's side of the family died of phthisis pulmonalis. The child was just lacking one month of being four years of age when she died. She had had none of the other diseases of childhood. The superficial cervical glands first enlarged in March, 1901, a seeming sequel to whooping-cough, and it is an interesting query whether this date represents the beginning of the Hodgkin's disease. If so, the child's age at the onset of the disease was two years and ten months. The posterior cervical glands which enlarged at this time never returned to a normal size, though the child was regarded as well, and only the mother's statement in reviewing the history confirms this fact, that she could always feel the kernels in the neck, though much diminished in size. It is an interesting query whether at this date the tubercle bacilli were the cause, or whether the cause was some toxin peculiar to Hodgkin's disease and as yet unknown. If the chief causative factor was a glandular predisposition, a type of tissue vulnerable to special or general micro-organisms, a so-called lymphatism and absorption through an abraded surface, either skin or mucous membrane of pyogenic micro-organisms, then the cause might have been traced to an eczematous eruption (which was present at this date, March, 1901), and which appeared over the occipital region. It was of a dry and scaly nature, and there were other much smaller patches over the body. Large crusts were on the nose, upper lip, and mouth. The tonsils were enlarged at this time, and there was a catarrhal condition of the pharynx, nasopharynx, and nasal mucous membrane. She was ordered an ointment containing menthol and salicylic acid, and an alterative mixture of the four chlorides was given. The skin lesions disappeared, glandular swelling decreased to almost normal in three months, and the child was considered well. Five months after the original attack (in August, 1901), the posterior glands on the right side enlarged, with febrile disturbance, and, following this, the anterior cervical on the same side and, in sequence, the anterior and posterior cervical on the left side. In appearance the glands seemed like the ordinary catarrhal adenitis often seen with influenza, or infections from the tonsil, and were regarded as of no more importance. Four chlorides were again given and the glands decreased in size; fever disappeared and the child seemed healthy, except the persistence of considerable glandular enlargement about the angle of the jaws. Surgical measures were suggested, with the view of removing, perhaps, tubercular foci of infection, but were refused. In October, with febrile disturbance, the glands still further enlarged and the axillary glands were palpable, and in November, in the third marked febrile attack, the glands in the groin were also palpable. In the periods of apyrexia the child never complained of pain, slept well, and played about as the other children of the family. In the febrile stage there was anorexia and sometimes nausea and vomiting. The fever was of a remittent type, and in each instance having a temperature

range from 100° to 102°, for one or two weeks, and then a longer interval of apyrexia, with a peculiarly ravenous appetite. The defervescence was slow and generally accompanied with sweating, the swelling of the glands in the neck and axilla diminished slightly in size in the apyretic intervals, though the glands were progressively larger from month to month until she presented the frightful picture as shown at the time of the child's death in April. During the latter months there was great respiratory distress and rapid breathing, pulse was over 120, profuse nose-bleeding occurred on several occasions. Puffiness about the neck, from pressure probably on the cervical and intrathoracic veins, occurred. Visible pulsation of the cervical vessels. Crepitation and small râles over the lungs. Liver and spleen were apparently enlarged in size, as indicated by palpation and auscultatory percussion. Urine was normal throughout, and no tubercle bacilli could be found in material coughed up or vomited. Lymphatic nodes involved cervical, axillary, and, late in the course of the disease, the retroperitoneal lymph glands were enlarged and formed a palpable mass to the left of the umbilicus. Œdema of the extremities also occurred at this time. The blood examination, made four weeks before death by Dr. J. Alison Scott, who saw the patient in consultation, shows: hæmoglobin, 48 per cent.; whites, 6066; reds, 3,624,000. Some poikilocytosis, no nucleated reds found. Differential count: polymorphonuclear, 86 per cent.; small lymphocytes, 12 per cent.; large lymphocytes, 1 per cent.; eosinophiles, 1 per cent.; total, 100 per cent. Death occurred eight months after the first attack of fever, and enlargement of the glands was accompanied with great distress, nausea, and vomiting.

Differential Diagnosis. 1. Lymphosarcoma; small-celled sarcoma of lymph glands involves organs rather than glands, and not the general involvement of one group of glands after another. It is sarcoma and usually adherent to the skin. It rapidly invades surrounding tissues, fuses with them, and destructive ulceration soon appears.

2. Local benign lymphomata; this is a simple persistent hypertrophy of certain glands of benign nature without extension.

3. Syphilitic adenitis will be diagnosed by the late symptoms, by diseased bones, nose and throat, keratitis, periostitis, and by the therapeutic test.

4. From leukæmia by the enlarged spleen, hemorrhages, diarrhœa, and by the blood examination.

5. From chronic or acute adenitis, time reveals its true nature, essentially a disease of infancy, slow increase, has a definite exciting cause, and terminates in resolution or suppuration.

Conclusions. It helps to lift the fog regarding Hodgkin's disease when so high an authority as Dr. J. H. Musser, agreeing with Sternberg, places himself on record that he regards the condition as of tuberculous origin, and the disease in fact tuberculous (*Philadelphia Medical Journal*, iii., No. 1, p. 13). There is circumstantial evidence in the fact that the lymph glands are one of the most frequent seats of the tuberculous process.

In Hodgkin's disease the process begins as a purely local disease, in a gland or chain of glands, and seems to extend by spread of germs, just as we may expect of *tuberculous* processes. Cases associated with eczema of the scalp, or any abraided surface of the skin or mucous membrane, which seems to be the starting point of many cases of Hodgkin's disease, we may explain by the fact that *tubercle* bacilli pass through the skin, without lupus or tuberculous skin inflammation, and, not finding in the skin favorable soil, pass on to neighboring glands of the neck or axilla in a predisposed individual.

Presumptive Evidence. An increasing number of diseases, formerly otherwise described, are now found to be of *tubercular* origin. Practically all primary pleurisies, scrofulous disease of lymph glands, bones and joints, chronic affections of the eye and ear, and other organs, lupus vulgaris, and Pott's disease.

The identity of the pearly distemper of cattle with *tuberculosis* and various other diseases, which have recently been classed with *tubercular* disease, makes one think that Hodgkin's, on account of its similar symptomatology, may also *belong* to *this class*. And if inoculation experiments only were regarded as proof, Hodgkin's disease might perhaps be added *definitely* to the list.

Only inoculation experiments with the suspected gland itself seems positive proof. Clinical observation, and even autopsy, with most careful histological and microscopic examination, has not unearthed the cause.

Many histological changes found at autopsy are undoubtedly due to secondary infection with secondary inflammations, which must give a great diversity in the anatomical picture and which emphasizes the necessity for inoculation proof.

Says Strümpell: "The tuberculous new-growth as such can

scarcely ever be recognized histologically from the infectious tumors, such as those seen in leprosy and syphilis," which again emphasizes the necessity for inoculation proof.

Even in phthisis pulmonalis there is a similarity in the fact that fever may be absent for a time, for weeks or months. And in fibroid unilateral contraction there may be no *fever* at all for periods, just as in *Hodgkin's disease.*

In phthisis we have the open avenues for pathogenic germs, while in Hodgkin's disease the comparative protection of the lymphatic system from secondary infection must necessarily greatly *modify* the *symptoms* in the two instances.

Even in the lung we find firm, cicatricial formation and cheesy masses that may be reabsorbed and undergo calcification, cases which are difficult to prove tubercular by histological detail, though we *now know them to be such.*

From the classical tuberculous glands, of course, Hodgkin's disease differs in its *final stages.* The final stages of classical tuberculous glands is cheesy degeneration and tuberculous ulcers.

In the fibroid glandular inflammation of Hodgkin's disease, the deficiency of bloodvessels, and consequent deficiency of nutrition, which causes this coagulation necrosis in the former instance may modify the result in the latter, the *cause* being the same.

Whether the glands shall suppurate and caseate as in the classical tuberculosis, or become fibroid as in Hodgkin's disease, is determined not so much by the character of the micro-organisms, nor by the virulence of the toxin, as by the nature of the lymphatic system itself, by hereditary or by an acquired cause.

The specific cause of Hodgkin's disease may be the tubercle bacillus, and, with little regard to the external anatomical characters of the glands in question, proofs must be regarded as insufficient and experiments incomplete without inoculation in the eye-chamber of the guinea-pig and awaiting the appearance of tubercle in the iris.

Anatomical characters without the now well-known proofs of inoculation are just as puzzling to us as they were to Laennec or Virchow and those earlier investigators who were ever at odds on the question of definitely established anatomical changes specific of tuberculosis.

Diffuse tubercular and cheesy infiltration and isolated tubercle were all found to be different manifestations of the *same* thing, from the proofs of inoculation, setting aside histological appearances. Minute cellular investigations of to-day present as little harmony over the question as grosser changes did in the earlier years; and a uniform anatomical basis for a definite decision of tuberculosis seems to have never been possible, and all classifications of glandular diseases as tuberculous or otherwise without inoculation experiments must be regarded as incomplete.

DISCUSSION.

Dr. John H. Musser: I have listened with interest to the paper of Dr. Ely, and I am perfectly well satisfied as to his conclusions regarding the cases which he presents of so-called Hodgkin's disease of tuberculous origin. The subject presents a great number of difficulties. One feels this because of the number of men who have been working on it, and working without being able to come to any definite conclusions. It seems that the larger number of these feel that the so-called Hodgkin's disease is an expression of tuberculosis. It is true that Fisher has pointed out that a number of cases of adenitis under his care have not responded to tuberculiu during life, and have not shown any but the histological changes of a chronic inflammation of the lymphatic glands after death. Dr. Reed studied a number of cases in Johns Hopkins, and out of a series of about seventeen cases there were two or three which did not respond to the usual tests during life and after death.

It seems, however, that those who uphold the tuberculosis theory have as good ground to stand upon thus far as those who are against it. Those opposing the theory can only show a few cases which were not tuberculous, and it seems to me those cases would fall in a class in which a chronic inflammation of the glands had taken place because of tuberculous infection, and had gone through the process, which resulted in healing, just as we have a similar localized inflammation in serous membranes or pulmonary structures, followed by analogous changes seen in the lungs, serous membranes, and other portions of the body as well as in the glands.

The more I study the matter the more I have to admit to myself the improbability of naming a cause for a very small group of cases of adenitis; consequently, if we consider Hodgkin's disease an entity it is a very rare affection. A number of cases are reported which did not show tuberculous lesions, but the number is very small, and it is not fair to

classify any but those which have been reported very recently, in which the modern methods for the determination of this process both during life and after death have been employed. Only since 1895 have these cases been so studied that it can be said of them that they are positively non-tuberculous. There were other causes for the death of these cases, and one cannot but feel that those who uphold the non-tuberculous origin of Hodgkin's disease have to prove their position before it can be positively maintained. The clinical course of more than 95 per cent. of the cases reported as Hodgkin's disease is undoubtedly tuberculous.

Dr. J. Alison Scott: I feel in attempting to discuss Hodgkin's disease that my experience with the disease has been comparatively limited, and what I have to say, therefore, is more from the standpoint of diagnosis and the blood examinations I have made than from cases under my own personal care. Within the past few years I have been very much interested in leukæmia, and I have been struck by the fact that lymphatic leukæmia presents many of the clinical aspects of Hodgkin's disease, but in this former condition the blood instantly clinches the diagnosis. In the chronic form of lymphatic leukæmia we have a large number of leucocytes. In several cases under observation in the last two years I have felt that chronic lymphatic leukæmia is a tuberculous disease. The acute lymphatic leukæmia presents a very different aspect, and has impressed me as being distinctly an infectious disease, beginning acutely and even terminating within ten days from the onset, before any of the lymphatic glands were enlarged, yet an enormous number of leucocytes were present in the blood. This leads to the thought that if acute lymphatic leukæmia is an infection the chronic process may be an infection of milder degree carried on, perhaps, in a person much more resistant to the process. When, however, we come to Hodgkin's disease and the condition characterized by general lymphatic enlargement of an elastic nature, with no tendency to break down, we have an entirely different picture and a different blood picture. In Hodgkin's disease the blood gives no indication of the disease. There is simply a secondary anæmia, as described in this case of Dr. Ely's, in which there was a moderate grade of secondary anæmia without other change in the blood. The fact that the blood gives no diagnostic hint is perhaps of some importance, because the same is true of tuberculosis. In ordinary phthisis the blood gives no hint. Within the last several years a number of tuberculous cases have been reported of different type than it was supposed existed. Lartigau, MacKenzie, and others, especially the French writers, have reported cases of hyperplastic tuberculosis in which the anatomical findings were those of hyperplasia, the microscopic examination showing very few giant cells; and sometimes there were no tubercle bacilli present, and when present not easily discovered. Such cases have been described in intestinal tuberculosis in which the entire gut has been

thickened almost an inch. Cases of laryngeal tuberculosis have also been described. Dr. Ely has referred to this in his paper, and it has struck me that Hodgkin's disease may be a tubercular lesion of that type—that there may be hyperplastic tuberculosis of the glands without the ordinary tendency to break down, and with perhaps that form of anatomical findings; yet it seems to me that if we consider a disease an entity we should find characteristic pathological data in that entity, and that it is the point where we seem to fail. The pathological findings in the so-called Hodgkin's disease or tuberculosis of lymphatic glands are extremely different in the different cases, and in those cases referred to by Dr. Musser, and worked out by Dr. Reed, I think the conclusion is that the pathology is entirely dissimilar from tuberculosis. In the cases in which we have had the opportunity of working up at the Pennsylvania Hospital, findings parallel to those of Dr. Reed have been very few. In one recent case the pathological findings were similar to Dr. Reed's. Therefore, the disease is an extremely difficult state to discuss. We do not know what it is, or the cause, except that suspicion points to the fact that it is tuberculosis of some kind. The idea that it is a sarcomatosis or of the nature of a malignant growth has never appealed very much to me. My ideas have inclined more toward its being a tuberculous rather than a malignant process.

Dr. F. P. Henry: I have as yet no settled opinion as to the tubercular or non-tubercular nature of Hodgkin's disease. The statement, however, that those who regard the disease as non-tuberculous are bound to prove their position is untenable. On the contrary, the burden of proof is on those who question the long-established belief that the disease is non-tubercular.

Dr. Scott has stated that he is coming to the conviction that lymphatic leukæmia of the more chronic variety is tubercular. It would require strong proof to convince me that tuberculosis of the lymph glands could be followed in one case by that remarkable condition of the blood characteristic of lymphatic leukæmia, and in another case by Hodgkin's disease, in which the blood is not materially altered, or at the most presents the signs of secondary anæmia.

It is true that cases apparently demonstrating a transition from the blood changes of Hodgkin's disease to that of leukæmia have been reported, and many years ago I was convinced that I had myself observed such a transition. I am now of the opinion that these so-called transitional cases were simply cases of Hodgkin's disease, with intercurrent leucocytosis from inflammation or other cause.

Dr. Musser has admitted that there are several well-authenticated cases of Hodgkin's disease in which the tubercle bacilli were not present. If that be the case—if there are genuine cases of Hodgkin's disease without

tuberculosis—it follows, of necessity, that tuberculosis is not an essential feature of Hodgkin's disease, and that the tubercle bacilli which have been found sparsely scattered in the glands in some of the cases are present accidentally or as a secondary infection.

There is a disease, however, whose position may be more justly regarded as transitional. I refer to the anæmia infantum pseudoleukæmia of von Jaksch. In this affection there is enormous enlargement of the spleen, profound anæmia, enlargement of lymph glands, and decided leucocytosis. In a case under my observation at the Woman's Hospital about a year ago the red cells were reduced to about 25 per cent. of the normal number; the leucocytes numbered about 75,000 to the cubic millimetre, and retained their normal proportions, although there were a few myeloeytes present; there were also normoblasts and megaloblasts, the former preponderating; and the spleen extended well to the right of the median line. The inguinal glands were much enlarged, and the patient—a girl, aged about six years—presented, as in von Jaksch's cases, marked signs of rickets. It is difficult to classify such a case, and we may provisionally adopt the view of Cabot, although he refers more especially to infants, that there are cases which are "apparently intermediate between leukæmia and pernicious anæmia."

In the course of this debate a statement has been made to which I must take exception. It was that a disease must present some uniform anatomical lesion in order to warrant its being regarded as a distinct morbid entity. We have only to consider typhoid fever in order to show the fallacy of such a view. Formerly all cases were excluded from the category of typhoid fever which did not present post-mortem the ulcerations of Peyer's patches. We now know that typhoid fever may exist as a septicæmia without the slightest sign of ulceration in the ileum.

To return to Hodgkin's disease. We were formerly satisfied with classifying it as pseudoleukæmia lymphatica, and we also spoke of a pseudoleukæmia splenica and of a myelogenous pseudoleukæmia. Such a classification is, I need not stop to point out, extremely faulty, but I am not aware that it has been superseded by any that is much better as a working hypothesis.

Dr. Ely (closing): The question has been so thoroughly discussed that I have nothing further to say except to suggest one more puzzle. When we regard leukæmia as so closely related to Hodgkin's disease, as Strümpell says, that one may merge into the other, it is worthy of note that no one has suggested tuberculosis as a cause of leukæmia. As to a difference between Hodgkin's disease and lymphatic tuberculosis, I think nearly all observers agree that clinically they can tell no difference; that pathologically they can tell no difference. In a large number of cases of so-called Hodgkin's disease they find proofs of tuberculosis. It seems to me that

the argument is hardly valid to say in the few negative cases that it is not tuberculosis. We have in those negative cases to take into account the variability of the tubercle bacilli and the variability of the soil. The bacilli may have been there and left the gland in a hyperplastic condition. I do not think the few negative findings are positive proof.

It would be interesting if the so-called Hodgkin's disease, the middle ground between leukæmia and lymphatic tuberculosis, should be eliminated as regards classification.

THE SURGERY OF BRAIN TUMORS FROM THE POINT OF VIEW OF THE NEUROLOGIST, WITH NOTES OF A RECENT CASE.

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[Read November 5, 1902.]

THE first operation for brain tumor at which I was present was performed by Dr. R. F. Weir, of New York, November 17, 1887, on a case in which the late Dr. E. C. Seguin had located a tumor in the face and arm centres. One month later, December 15, 1887, I was present at an operation at St. Mary's Hospital, Philadelphia, when Dr. W. W. Keen removed a large fibroma from the parietal region. It might be remarked, in passing, that in the case of Weir and Seguin the patient was improved and lived a considerable time, and that in the case of Keen the patient is alive and in good condition, except for the damage already done by the tumor. I examined him more than ten years after the operation. During the fifteen years which have elapsed since these two historical cases, I have seen many operations for the removal of brain tumors. A large number of these have been on cases which came into my hands for diagnosis and in which I advised surgical procedure; another considerable percentage has been of cases in which I have been called in consultation, either alone or with others, to decide upon the propriety and fix the site of operation; in a third set of cases I have had the privilege, through the courtesy of my neurological and surgi-

cal friends, of being present at operations on patients with whom I had had no professional relations.

In order to draw conclusions for this paper I have tabulated from this personal experience twenty-two cases in which operation was performed after the diagnosis of tumor or cyst had been made.

I believe in operations for the removal of brain tumors in carefully chosen cases, and this notwithstanding the fact that the percentage of failures in such cases up to the present has been large. This is to be expected. In almost every case the outcome without operation is necessarily fatal, and in the majority of cases surgical procedure has been postponed too long. With more exact localizations, with more precise craniocerebral topographical methods, and with more perfect surgical technique, the percentage of successes has been and will be much increased. By success is meant that the removal of the tumor is followed by complete or large subsidence of symptoms, and by fair guarantee against their recurrence. This is a result to be hoped for when the tumors are fibromata, encapsulated fibrosarcomata, inert gummata, and occasionally in other forms of neoplasms. Success can also be properly claimed when the removal of the tumor is followed by relief of painful and distressing symptoms, when the patient's life is prolonged, and he is enabled to live for several or many years in comparative comfort and usefulness.

After a general presentation of my observations and conclusions, I shall append the notes of a recent unreported case of great interest both from the neurological and surgical points of view.

The causes of failure in operations for brain tumor are: (1) Mistakes in localization; (2) lack of exactness in fixing the cranial areas for operation; (3) excessive hemorrhage; (4) concussion and even contusion of the brain in osteoplastic operations with chisel and mallet; (5) prolongation of operations; and (6) the sudden disturbance of the balance of pressure in the skull by the removal of large, hard tumors. The elements of success are simply the reverse of the picture just presented in tabulating the causes of failure.

It is possible that I may be called to account for discussing a subject most of which properly belongs to the surgeon; I do not

make the slightest claim to the surgeon's prerogative, but the frequent onlooker, especially if he is personally interested, may acquire the right to discuss matters critically. The development of an art is advanced not only by the work of the artist, but by the observations and criticisms of those who have a deep concern or interest in his productions.

Serious mistakes in localization occasionally occur, but on the whole the neurologist presents an increasingly favorable record in this respect. Out of twenty-two operations in only two was the localization entirely wrong. In one other case two lesions were present, but the most important of these was not in the position of the opening. In two cerebellar cases the tumor was not removed, although present, but too deep to be reached. In several cases, while the localization was correct, the tumors were largely subcortical, and, hence, only partially removable. When mistakes in localization have been made they have been usually in regard either to regions largely latent, like the right temporal lobe or right prefrontal region, or with regard to cerebello-bulbar cases. Tumors of the cerebellum often present especial difficulties. This is probably because that, while they so frequently involve the vermis, they tend to invade other parts, as one lateral lobe, the peduncles, or the bulb.

When the localization of a growth is for the purpose of exactly fixing the limits of an operation, the method in which the tumor has spread, as determined by a careful study of the history of the development of symptoms in the case, is often of great importance. Much attention must also be paid to compression symptoms. A tumor largely postparietal or prefrontal may at a late period present such prominent motor symptoms, for instance, as to lead the neurologist to believe that the operation should be mainly or solely with the purpose of exposing the motor area.

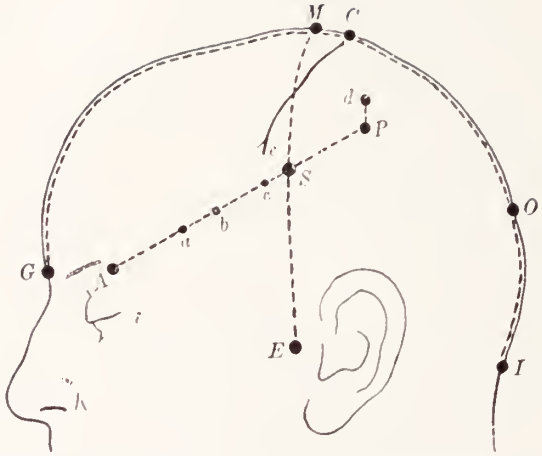
The importance of Röntgen-ray investigations in locating brain tumors is becoming more and more apparent. In two previous papers, in the *Philadelphia Medical Journal*, I have recorded X-ray investigations made for me on cases of brain tumor. In both of these cases the shadow of the tumor was obtained. Operation and autopsy confirmed the finding in one case, and operation alone in

the other. Numerous experiments made on the cadaver, at my suggestion, by Dr. G. E. Pfahler also demonstrate the fact that not only tumors, but lesions of less density than the brain substance and not homogeneous with it could be differentiated by the X-rays, these giving areas of less shadow than the normal brain tissue. Previous to the publication of these papers a tumor of the cerebellum had been localized by Church and Fuchs, of Chicago, by means of the X-rays. I have an additional case to add to this series, a case the notes of which will be appended to the didactic portion of this article. These cases show clearly that, whenever it is possible, a Röntgen-ray investigation should be made when brain tumor is suspected. It is only by experience and close attention to every detail as to exposure, distance of the plate from the skull and character of the vacuum, that favorable results can be obtained.

Dr. Henry K. Pancoast, assistant instructor in clinical surgery, skiagrapher to the University Hospital, at my request investigated several cases of supposed tumors or cysts of the brain. In a patient in whose case cerebellar tumor was diagnosed, and on whom an operation was performed for me by Dr. Charles H. Frazier, a shadow was obtained, but the tumor was not found on operation, although it may have been present, but deeply situated. Dr. Pancoast reported regarding this case as follows: "From the level of the occipital protuberance downward to the shadows of the vertebræ was a clear space best seen on the plate. In front of this was a definite shadow which was supposed to be due to the tumor. After opening the dura a large collection of clear cerebrospinal fluid was evacuated and of sufficient quantity to account for this clear space. It was impossible to demonstrate the presence of a tumor. Other plates also showed a shadow in this region and were skiagraphs of a dry skull from the hospital skeleton. These shadows were evidently cast by the base of the petrous portion of the temporal bone. The shadow, however, was not present to any marked degree in two other plates, one of Jacksonian epilepsy and one of supposed tumor, though in the latter a vague shadow was seen."

When a tumor has been accurately localized, success in a few

Fig. 1.



Craniocerebral guiding lines traced upon a photograph of one of the casts prepared by Professor Cunningham: G, glabella; I, inion; M, mid-sagittal point, midway between G and I; A, external angular point; S, squamosal point, intersection of oblique and frontal lines at junction of middle and lower thirds; P, parietal point, termination of oblique line equidistant with b from squamosal point; E, pre-auricular point; a, "commencement" of fissure of Sylvius, five-twelfths of the distance from A to S; b, bifurcation of fissure of Sylvius, seven-twelfths of the distance from A to S; d, termination of fissure of Sylvius, one-half inch (1.25 cm.) above P, in a direction parallel to frontal line; Cc, central fissure; C, upper extremity of central fissure, three-eighths of an inch (0.9375 cm.) behind the mid-sagittal point; c, lower extremity of central fissure, carried to oblique line in direction of fissure, three-eighths of an inch (0.9375 cm.) in front of the squamosal point; O, parieto-occipital fissure, on sagittal line seven-twelfths of the distance from M to I; the dotted line from G to I is the "sagittal line;" the line from A to P is the "oblique or squamosal line;" the line from E to M is the "frontal line." (After Anderson and Makins.)

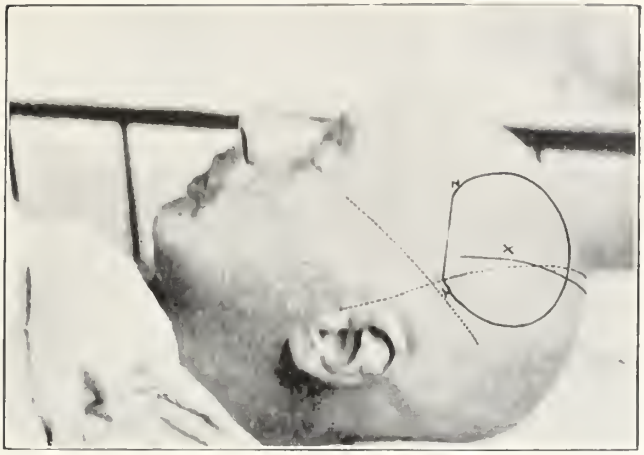
instances has not been as complete as it should have been, because sufficient care has not been taken in mapping out the cranial area previous to the operation. This can be done so certainly and with such small expenditure of time that there is no excuse for waiting until just before operation hastily to fix the position of the fissures, lobes, or convolutions. A mistake of less than an inch in locating the antero-posterior position of the central fissure or the height of the horizontal branch of the Sylvian fissure may add considerably to the uncertainties and difficulties in an attempt at the removal of a brain tumor by making the opening so as only partially to include the neoplasm. In these days of large openings it is not sufficient to localize so as to bring only half or less than half of the neoplasm into the field of operation.

Usually I prefer to use the Anderson-Makins method of locating the chief craniocerebral landmarks (Fig. 1). These writers suggest: "1. A median sagittal line, from the glabella to the inion. 2. A frontal line, from the mid-sagittal point to the depression just in front of the ear at the level of the upper border of the meatus. 3. A squamosal line, from the most external point of the external angular process, at the level of the superior border of the orbit, to the junction of the middle and lower thirds of the frontal line, and prolonged for about an inch and a half behind the frontal line. The upper extremity of the central fissure was found by them to lie between the mid-sagittal point and a point three-quarters of an inch behind it, and the lower extremity of this fissure they located near the squamosal line, about three-quarters of an inch in front of its junction with the frontal line. The commencement of the lateral portion of the Sylvian fissure is not at a definite fixed point, but will usually be hit at a point from one and a half to two inches behind the angular process, the course of the horizontal portion of this fissure corresponding closely to the squamous line. The parieto-occipital notch is placed at a point seven-twelfths of the distance from the mid-sagittal point to the inion. The longitudinal sinus frequently deviates toward the right side in the caudal portion of its course."

My own method of procedure in a case of operation for brain tumor is, whenever possible, not only to locate the position of the

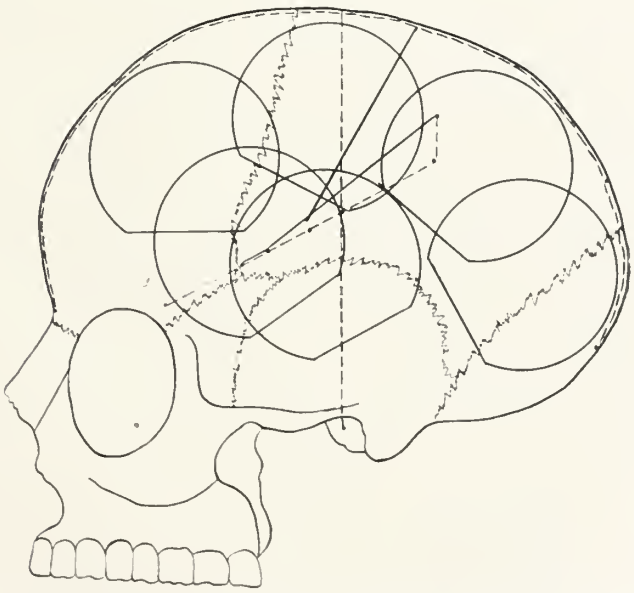
tumor, but also exactly to fix the limits and direction of the osteoplastic flap which it seems most desirable to make. In the present contribution I shall illustrate this by only one example. If the intention is to remove a tumor accurately limited to the motor region, as in the case the history of which is appended to this paper, the central fissure and horizontal branch of the Sylvian fissure should first be indicated on the shaven scalp; then the area supposed to include the underlying tumor should be exactly mapped out; and, finally, the base line of the flap which the surgeon is to make should also be indicated. The illustration (Fig. 2) shows exactly the method of carrying out these directions. The squamosal line, which corresponds fairly well to the Sylvian fissure, and the line of the central fissure, having been determined by the Anderson-Makins method, the spot for the insertion of the pin of the Stellwagen trephine is next determined. As the arm of this trephine can be extended so as to give a radius of nearly two inches, the point selected for the pin should be about one-half inch in front of the central fissure at about its middle or a very little below this point. It is now generally believed that the motor region is largely in front of the central fissure, and the circle outlined by the arm of the trephine when the pin is placed in the position just stated would be such as to include a little more than the motor region forward and backward, while it would nearly uncover it toward the median line and also in the direction of the Sylvian fossa. The Anderson-Makins lines and the circle can readily be marked on the scalp with a tape-line, compasses, and an aniline pencil. The base-line should be about one and one-half inches in length, and should so bisect the lower portion of the circle as to cross the line of the central fissure at its lower extremity and at right angles to it. In the illustration (Fig. 2) the position for the pin of the trephine is indicated at X, while the base-line extends from Y to Z. When these points have been determined by careful measurement the scalp can be marked by small incisions at X, Y and Z. At the time of operation it is then only necessary for the pin to be inserted in the proper position in the scalp, and for the knife to be inserted at one end of the base-line and swept around the circle until it reaches the other

Fig. 2.



Photograph of the motor region outlined on the skull previous to osteoplastic operation with the Stellwagen trephine: X, point for the insertion of the pin of the Stellwagen trephine; Y, Z, base line; the other lines and points are the same as in Fig. 1.

Fig. 3.



Cranial areas for osteoplastic operations with the Stellwagen trephine, these areas corresponding to the regions of the left hemicerebrum with definite syndromes.

end. No time is then lost in determining the direction and length of this line. The aniline markings can, of course, be removed when these positions have been determined, as will be necessary in order to complete the sterilization of the scalp before operation.

Whenever large openings are to be made, and the Stellwagen trephine is to be used, the same method should be followed, that is, the effort should be made accurately to mark out not only the limits but as nearly as possible the direction of the osteoplastic flap, as well as the extent and direction of its base line. I have seen five to ten minutes lost in endeavors to locate the proper position for the base line, with the chances that even then it was not in the best position and direction.

The large osteoplastic operation is the only operation that should be employed for the removal of brain tumors, except when the tumor is located in some region in which this operation is not feasible, as when the trephining is to expose one lateral lobe of the cerebellum, or, perhaps, when it is intended to reach a tumor located under the cerebrum.

With the permission of my surgical friends I should like at this point to say a few words about the old trephine and rongeur, the mallet and chisel, and the Stellwagen trephine in particular. The opening made by the ordinary trephine is very rarely, if ever, large enough for the purpose of removing a brain tumor, so that when it is used the rongeur is almost necessarily resorted to to complete the opening; or it may be necessary to make several trephine openings and connect them by rongeuring. While this method was of course the best that could be used until recently, and while many surgeons have become unusually skilful in the use of the trephine and rongeur, the method has always seemed to me crude and undesirable. It consumes much time and work, and usually leaves a ragged opening covered by the scalp, unpleasant in appearance, and exposing the patient to injuries from which he is protected by the intact skull. When, through the kindness of Dr. Keen, I had had several opportunities of seeing osteoplastic operations, I became convinced that this method of operating was the only desirable one in most cases of brain tumor. Two objects of great importance were realized by its use,

the uncovering of a large brain area and the replacement of the bone flap which retained its vitality. Several years since I had the opportunity of seeing two or three attempts to replace buttons of bone which had been removed by the trephine and kept during the operation as nearly as possible aseptic and at the temperature of the body. The bone usually necrosed and caused much trouble. The osteoplastic flaps which I have seen have retained their vitality in almost all instances.

With the advent of the Stellwagen trephine a new era in the marking of large osteoplastic flaps has been inaugurated. We owe to Dr. J. Chalmers Da Costa, Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College, the introduction of this trephine to the profession (*Annals of Surgery*, July, 1902, vol. xxxv., No. 7). Both Dr. Da Costa and Dr. Hearn have suggested important improvements in this instrument or its accessories.

A few surgeons have become very expert in the use of the chisel and mallet, but even in their hands the concussion produced and the time taken are weighty objections. I have long thought that the dental engine might be used in order to make large bone flaps in shorter time and with less concussion, but owing to difficulties in keeping the cutting accessories aseptic, and owing to the dangers of injuring the brain, surgeons generally have been opposed to this method of operating. The Stellwagen trephine affords the means of opening the skull without concussion and with neatness and dispatch. In an operation performed by Dr. Hearn on a patient whom I saw in consultation, and on whom I outlined the cranial flap, a trap-door of bone and scalp nearly four inches in diameter was lifted just thirty minutes after the first knife-cut was made. In an operation recently done for me by Dr. Hearn, at the Philadelphia Hospital, a similar opening was made in eighteen and one-half minutes. Mallet and chisel operations for openings of similar size certainly take in some instances twice or thrice this time, or even more. Another advantage from the use of the Stellwagen trephine is that the bone flap neatly and exactly fits into the opening which has been made when it is replaced after removal of the tumor, this not only leaving the

head much less unsightly than is usual in other operations, but adding to the probability of reunion and more perfect vitalization.

It scarcely needs to be said that the most desirable positions for osteoplastic operations are anywhere on the lateral aspect of the cranium above the line of the tentorium—over the prefrontal, the motor, the parietal, the occipital, the occipito-temporal, parieto-temporal or temporal regions of the skull. Here excellent opportunities are offered for a large flap, and also for the most advantageous use of the Stellwagen trephine. The least desirable portion for such operations, as has already been partly pointed out, are at the base of the brain and below the tentorium. In Fig. 3 are shown the most desirable positions for six osteoplastic operations designed to uncover six of the physiological regions in which tumors are often found. What seems to me to be the best position and direction for the base line is given in each case. The illustration is intended to show osteoplastic flaps made by means of the Stellwagen trephine. In a paper read at the Saratoga meeting of the American Medical Association, and published in the *Journal* of that Association October 4, 1902, I have indicated similar positions for these operations when the chisel and mallet are used, giving also the definite syndromes for each of these positions.

Unusual difficulties and dangers attend cerebellar and basal operations for tumors. With regard to the cerebellum, I believe that the best operation is one in which the interfering neck muscles are turned back and a good opportunity thus afforded for the scalp flap and the use of the ordinary trephine. If great care is taken in placing this trephine, the sinuses can be avoided and the opening can be slightly enlarged by the rongeur, so that a tumor confined mainly to one lateral lobe of the cerebellum may be removed. Unfortunately, however, the majority of cerebellar tumors originate in the middle lobe and the peduncles, hence, insurmountable difficulties in removal are encountered. Still, an operation is justifiable in cases in which a tumor is probably situated laterally in the cerebellum. It has been suggested that in the case of a cerebellar tumor situated laterally and somewhat forward, operation should be performed by entering the skull in

the middle fossa and cutting away the petrous portion of the temporal bone. According to Dr. Keen, the only case in which operation for a brain tumor situated in the posterior fossa could be performed by entering the middle fossa is when such tumor is situated on the under surface of the cerebellum and laterally to the pons, and cannot be reached in any other way. In this case it is a possible, but difficult, operation to do by lifting the temporal lobe and incising the tentorium behind and parallel to the ridge of the petrous bone. As I observed in one instance in an operation by Dr. Keen, the temporal lobe may be difficult to lift, either because of the increased pressure caused by the tumor itself, or because of the accompanying hydrocephalus. Tumors situated laterally at the junction of the cerebellum and pons may by good fortune be pedunculated, and therefore removable. This was seen in one case of brain tumor which came to autopsy under my observation. The proximity of the great sinuses adds difficulties to cerebellar operations. I was present at several demonstrations made by Dr. Keen on the cadaver, these being performed to show the possibilities of operation for tumors of the pons, crus, and cerebellum. It was evident that these parts could all be thoroughly exposed, as will probably be described by Dr. Keen himself. At these demonstrations it seemed both to him and to me that the best methods of attempting to remove a tumor of the vermis would be to make two openings, one a short distance on each side of the median line as close as possible to the sinuses. This would enable a thorough exploration from one side to the other, and might in an exceptional case afford the opportunity of removing a tumor. Dr. Keen believes that these two openings can be made into one by cutting away the intervening bridge of bone without injury to the occipital sinuses, which are small, and in addition the dura could be divided all the way across. The occipital sinuses could either be ligated before division or seized and ligated after division. This would give a wide access to the upper surface of the cerebellum.

In several of my tabulated cases excessive hemorrhage either from scalp, bone, or intracranial parts has been the cause of failure, and directly or indirectly of death. In one case the

method of controlling hemorrhage during the operation by temporary compression of the carotids was employed. My attention was called to this method by a paper published by Dr. George Crile, of Cleveland, Ohio, in the *Annals of Surgery*, April, 1902. In a communication to the *Philadelphia Medical Journal* of October 25, 1902, Dr. Robert W. Johnson, of Baltimore, states that he was the first to suggest a device for turning off the carotids in operations on the head and neck; and in a still later communication to the same journal, November 8, 1902, Dr. Max R. Dinkelspiel indicates that prior to both Drs. Johnson and Crile the method of compressing the carotids to control hemorrhage during operation was suggested by Senger (1895), Riese (1896), Kocher and others. However interesting this discussion of the question of priority may be, it is not germane to this contribution. The only point that I wish to make is that it would seem desirable for the surgeon, before beginning an operation for brain tumor, to have at command the best appliances for temporary compression of the carotids. In connection with the subject of hemorrhage a matter of interest regarding the use of the Stellwagen trephine may be noted. The incision made by the knife carried by the arm of the trephine, when the flap is of large diameter, is of such length that it may be difficult to catch all the vessels cut as speedily as desirable if the incision is made with a single sweep of the instrument. It is, therefore, better that the knife-cut should be carried to a certain distance, the vessels then tied, the knife carried to another portion of the circle, and so on until the arc is completed. On a number of occasions I have seen the Horsley cement or wax do good service in controlling hemorrhage from the bone.

Horsley and Macewen have divided operations for brain tumor into two stages in order to avoid the ill-effects of the shock of a long-continued operation. In the first stage the dura is exposed and the wound packed with gauze. In the second stage—some days later—the operation is finished. In exceptional cases I believe that the operation should be done in two stages—when, for instance, the patient's condition before or during the operation is bad, or when unusual difficulties and delays are met with in the

course of the operation. With regard to the sudden disturbance of the balance of pressure in the skull by the removal of large, hard tumors, I simply offer this matter for consideration. In some cases collapse has threatened or has taken place when neither hemorrhage, concussion nor other evident cause of collapse was present. It has seemed to me probable that the rather sudden change in the conditions present within the skull by the removal of a tumor which has grown slowly and allowed the brain to accommodate itself to its presence, might account for this.

I append the notes of a case recently operated on for me by Dr. W. J. Hearn, in which the methods of procedure, both as regards localization and surgery advocated in this paper, were more completely carried out than in any previous case.

Localized Meningitis and Gumma of the Motor Region —Diagnosis by Clinical Study and the Röntgen Rays —Osteoplastic Operation with the Stellwagen Trephine—Epicranial Flap to Replace the Dura Necessarily Removed—Complete Success of the Localization and of the Operation.

OPERATION BY W. J. HEARN, M.D.,
CLINICAL PROFESSOR OF SURGERY IN THE JEFFERSON MEDICAL COLLEGE.

RÖNTGEN INVESTIGATION BY G. E. PFAHLER, M.D.,
DIRECTOR OF THE RÖNTGEN-RAY LABORATORY OF THE PHILADELPHIA HOSPITAL.

R. T., aged twenty-seven years, was first admitted to the Philadelphia Hospital September 17, 1901. He gave a history of having been struck by a stone over the left parietal region eleven years previously. He denied having had syphilis, but he had been an alcoholic for several years. He said that he had been perfectly well until eight months before admission, when he began to have spells of dizziness about twice a week. He had had headache every other day for six or eight months. For about

two weeks before admission he had impaired vision, according to his statement, in the left eye only. He had vomited but two or three times since the beginning of his trouble. His headache was on the left side, and was both frontal and occipital; occasionally he had headache on the right side. The pain was sharp, and extended down the left side of the face as far as the angle of the jaw; tenderness was present on pressure over the left supra-orbital and infra-orbital nerves and at the left mental foramen. There was no tenderness over the exit points of the fifth nerve on the right side. The patient said that he was deaf in his left ear, but when the finger was placed in the right ear he replied to questions asked in a low voice.

When examined at the time of his first admission the motor power in the left lower extremity was distinctly diminished, and resistance to passive motion was feeble; the motor power in the right lower limb seemed to be normal, and resistance to passive movement was good. Weakness in the left arm and leg developed slowly, that in the arm preceding that in the leg by about one week. Knee-jerk on the left side was distinctly exaggerated, but patellar clonus could not be elicited on either side. Knee-jerk on the right was prompt. Achilles jerk was about normal on both sides. The Babinski reflex was not obtained on either side. Sensation for touch and pain was normal in all parts of the body, including the face. Stereognostic sense was not impaired in the upper limbs. The dynamometer showed somewhat impaired grip in both hands. In walking the patient occasionally lurched to one side or the other.

At this time, as will be noted from the history, the patient's symptoms, at least those referable to his extremities, were largely, although not exclusively, left-sided. He was, however, much troubled with headache, especially on the left side of the head, and with attacks of dizziness. The reflexes on both sides were active, although more so on the right. All the symptoms pointed to cerebral or cerebro-spinal syphilis, the cerebral lesions probably being of the nature of a gummatous meningitis affecting the membranes of the right hemisphere. Treatment at this time consisted in the use of large doses of potassium iodide, 100 grains a day

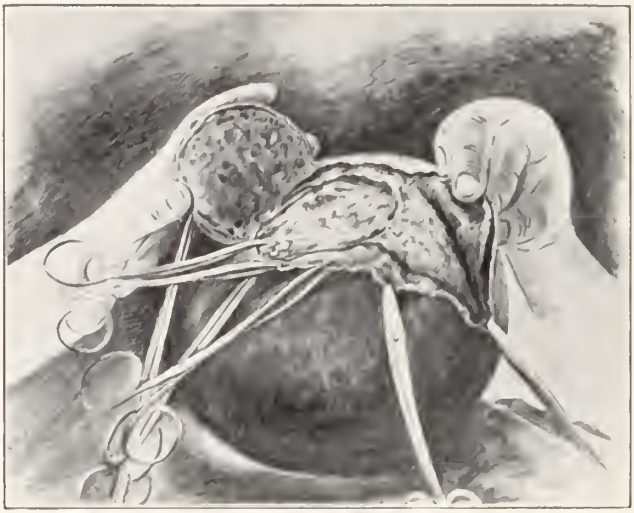
being the maximum dose. Rapid improvement followed, and the patient was discharged.

On June 19, 1902, he was re-admitted suffering from the same train of symptoms as given above. He was again placed upon the specific treatment, his symptoms disappeared, and he was discharged.

His last admission was on October 4, 1902. His most prominent symptoms at this time were extreme pain in the left parietal region, frequent spasmodic seizures, beginning in the right hand and arm, and later involving the right leg and the right side of the face, with temporary partial loss of power in the right arm and leg after the seizure.

Examination showed the pupils to be dilated and the iritic reflex to be feeble for light and distance. The tongue was tremulous and protruded in the median line. There was no involvement of the facial muscles, and no tenderness over the course of any facial nerve distribution. Tenderness was extreme over the left parietal scar and over the surrounding region for a distance of three inches or more. Grip in the right hand was slightly impaired. Sometimes immediately after a spasm loss of power in the right arm and forearm was marked. Biceps jerk in both arms was slightly increased, and triceps jerk was normal in both arms. Tactile, pain, thermal, and stereognostic senses were normal in the upper extremities and in the trunk. Voluntary and resisted movements in the right leg and foot were slightly impaired. Knee-jerks were exaggerated on both sides, more markedly on the right. Ankle clonus was present on both sides. The Babinski reflex could not be obtained on either side. Tactile, pain, and thermal senses were unimpaired in the lower extremities. Under the continued use of mercury and the iodides in maximum doses no improvement took place in either the spasmodic seizures or in the localized tenderness in the left parietal region, and only slight improvement in the headache. The eye examination by Dr. G. E. de Schweinitz, October 15, 1902, showed some atrophy of both optic nerves, evidently consecutive to a neuritis. Hemianopsia was not present, and the iritic reflexes and ocular movements were normal.

FIG. 4.



Photograph (retouched) showing the appearance presented just after the removal of the membrane and tumor.

FIG. 5.

Photograph of the appearance presented by the head two weeks after operation, showing the absence of all depression and the close apposition of the flap to surrounding parts.

On October 14, 1902, an X-ray examination of the head, by Dr. G. E. Pfahler, showed good detail, including on the left side a fissure involving the inner table of the skull apparently at the position of the fronto-parietal suture. The investigation also revealed a shadow, irregular in outline, oblong, about three inches in length, one inch or a little more in width, extending across the middle of the line of the central fissure and traversed at its centre by the middle meningeal artery. The patient was operated on October 21, 1902. Before the operation the area for trephining was laid out according to the Anderson-Makins method.

The Stellwagen trephine was used at the operation. The scalp was found to be œdematous and thick, so that the plate of the trephine would not fit closely into the bone structure. A semilunar incision was therefore made, the scalp dissected back, and the plate fitted directly into the bone. The trephine was given a radius of about two inches. In making the scalp incision there was considerable bleeding, all of which was controlled by hæmostats. The bone was sawed through in the circular line of the knife-cut, and although the bone was unusually thick, only eighteen and one-half minutes elapsed from the time the scalp incision was made until the trap-door of bone and scalp was raised and turned back. Little bleeding occurred, and that only from small vessels in the dura.

The dura was adherent to the skull over a considerable portion of the bone flap, which had to be pulled away from the membrane. When the membrane was fully exposed it was found to be very thick, in some places at least four or five times thicker than normal. The dura, pia, and arachnoid were adherent, and the agglutinated membranes were also adherent to an oblong, flat mass, which corresponded almost exactly in its dimensions to the shadow furnished by the Röntgen-ray investigation. The inflamed, thickened, and adherent membranes and tumor together formed a mass of just such density as would probably give a shadow. As it was found impossible to dissect the membranes from the mass beneath, it was decided to remove membranes and tumor together. (See Fig. 4.) This was done with but little disturbance of the brain tissue. To replace the removed dura

advantage was taken of a suggestion by Dr. Keen, and an incision was made in the scalp outside of the line of the main opening. The scalp was turned back, and a piece of the pericranium was dissected loose and inserted into the opening left by the removal of the dura. This piece of pericranium was turned upside down, so that the osteogenetic surface would be away from the brain and not next to it. The membranes and mass were given to Dr. William G. Spiller for examination, who reported the tumor to be a gumma.

The bone flap was replaced and fitted perfectly; scalp incisions were next sutured, and small iodoform gauze drainage placed in two places. The patient recovered from the ether promptly, and, with the exception of one postoperative sinking spell, he has not had any unfavorable symptoms. During the forty-eight hours immediately following the operation he had several slight spasmodic seizures involving solely the right side of the face, but these have not recurred since. There is no further loss of power in the right arm or leg, nor impairment of sensation. His headache has entirely disappeared. The patient's general condition is good. In Fig. 5 is shown the appearance of the head two weeks after the operation.

At the time of making this last note, just four weeks after the operation, the man has made a perfect surgical recovery, his headache and Jacksonian epilepsy have disappeared, his eyes have improved, and he is in all respects in excellent condition.

DISCUSSION.

Dr. Harvey Cushing, of Baltimore: The "point of view of the neurologist," as expressed by Dr. Mills, is so much a surgical point of view that there does not seem to be a great deal left for me to say. There are few operators, indeed, even among those specially interested in neurological problems, who, in the present state of disrepute of brain surgery, would dare advocate their particular therapeutic measure as strongly as Dr. Mills has done for them.

It is interesting to recall that only ten years ago, possibly the best known of the distinguished line of Philadelphia surgeons, Professor Agnew, con-

cluded an admirable paper on the then "Present Status of Brain Surgery" with the words: "It is more than probable that, as our observations multiply, the sphere of the trephine as a preliminary measure for the removal of brain tumors will be lessened rather than amplified." It is noteworthy, furthermore, that at that time he could only record from all Philadelphia the experience gained from four operative cases.

Despite this foreboding, in no locality during the past decade has so much been done by the combined efforts of expert neurologists and surgeons for the furtherance of operative relief in these very cases. The opinion which Agnew voiced was that of the conservative medical world in general, and was an expression of the natural reaction which at the time had followed the early hyperenthusiasm with which intracranial problems had been attacked. Operators with meagre knowledge of neurological conditions, and the neurologist with even less familiarity with surgical limitations, so upset the balance that it is only just beginning to find a quiet and justifiable level. History repeats itself, and the misfortune of early brilliant successes in other fields of surgery has invariably caused a corresponding upheaval and reaction. Dr. White's remarkable discovery, Bier's spinal cocainization, etc., might be cited as similar instances of valuable procedures temporarily in some disrepute owing to their widespread and misdirected application by enthusiastic rather than discriminating operators.

The oft-quoted statistics of Allan Starr, of Hale White, and of Seydel, published at about this same time, added further to the seeming hopelessness of operative procedures in showing that only 6 to 7 per cent. of all cases of brain tumor found at autopsy would be amenable to operative removal, even had they been previously localizable. It is only fair to say, however, that post-mortem conditions cannot always be relied upon as a basis for statistics of operative possibilities. How large a percentage of cases of new-growth elsewhere would be considered operable in the stage at which they are brought to light on the autopsy table? However, granting that these figures approximate the truth and that it may be possible by removal of a tumor to save even this small percentage of individuals suffering from an incurable, painful, and slowly progressive disease, the surgeon needs no further justification.

There is, moreover, another side to the question other than that of pure removability of a tumor which bears consideration and upon which I would like to dwell, especially as it has not come within the scope of Dr. Mills' paper. The symptoms resulting from an intracranial growth seemingly may be put in two distinct groups: the "Grundlage" of symptoms, on the one hand, due to the general increase of intracranial tension with its resultant disturbances in circulation of blood and cerebro-spinal fluid, occasioning the familiar triad of symptoms—headache, vomiting, and optic neuritis; on the other hand, the superimposed symptoms due to disturbances more or less focal in character, whether irritative or paralytic, giving

us a lead, as they may do, to the primary location of the disease. It is for the relief of the former, the underlying group of symptoms, that I think operative measures should be directed, even before the hoped-for evidence of localization has been given. By the removal of a sufficiently wide area of bone intracranial tension may be relieved, and the sorry period of months between the first onset of symptoms and the time when localization may favor an operation directed toward extirpation of the growth, or when exitus may end the story, can thus be passed in comparative comfort. This "trepanation dé compressive" of the French, should, of course, not be aimless in its direction, and there is always a chance that a well-judged osteoplastic operation may disclose the growth occupying an underlying silent area of the cortex. Should this not be the case the bone must be removed, for the chief objects of the operation are to give relief from pain and, still more, to ward off menacing blindness. It is an experience which has come to many others than myself to remove an intracranial growth and to have an existent and long-standing "stauungspapille" go on to atrophy and complete loss of vision. Even in case the condition prove to be luetic the operation should have done no harm, and the distressing symptoms should disappear immediately, and iodides then be given. Dr. Mills' remarkable case, indeed, shows, as has been pointed out before, that iodides may not affect a certain form of gummatous tumor.

Dr. Fitz, in a recent paper, "Some Surgical Tendencies from a Medical Point of View," decries the modern tendency of surgeons toward exploratory operations for purely diagnostic purposes and toward operative procedures which hold out no prospect of permanent relief, saying that "Any operation which does not better the condition of the patient must be regarded as a therapeutic error, since the knowledge thus obtained shows that the operation should not have been performed." The mere prolongation of life, furthermore, provided the same is not made more livable, is by no means a sufficient justification for surgical therapy. I would not wish to be considered a surgeon with a distorted idea of the possibilities of the scalpel, but I do think that operation for these conditions under discussion does not conflict with the wise restrictions laid down by Dr. Fitz. The operation, exploratory though it may be and disclosing probably no growth, possibly an irremovable one, has for its chief aim not so much the prolongation of life as the relief from suffering during those months which remain.

Speaking, as has Dr. Mills, from the standpoint of the neurologist, Alfred Sänger, at the last German Surgical Congress, presented a paper, "Ueber die Palliativoperation des Schädels bei inoperablen Hirntumoren." In spite of the pessimistic views which many eminent German surgeons hold as to the narrow limits of brain surgery, he comes out as a strong advocate of trepanation, such as I have mentioned, in every case of diagnosticable tumor. He reports a series of eleven cases of this palliative operation, in

only one of which was there not an immediate subsidence of symptoms lasting from periods of six to twelve months. The failure in this case was due to the pressure of the growth against the Sylvian aqueduct, causing an internal hydrocephalus. In two of the patients the operation had been too late, and blindness ensued. In the other eight the optic neuritis subsided completely. He says, if I may translate from his paper, "In short, palliative trepanation in case of cerebral tumor, an operation which, even if not absolutely free from danger, is of extraordinary blessedness and in the hands of a practical surgeon one that I would like to recommend in every case, in consideration of the impotency of internal medicine and in view of the distressful (qualvollen) suffering and, above all, of menacing blindness."

I would like to speak for a moment of certain features of the operative technique which Dr. Mills has already touched upon. Contrary to the general opinion which has very properly been moulded after the leadership of Sir Victor Horsley, I believe that chloroform is a dangerous anæsthetic for these cases. The very reason why it is recommended, namely, that there is less bleeding, is an acknowledgment of the risk of its employment. The cause of this comparative freedom from hemorrhage is a lowered blood pressure, a dangerous condition of itself, and especially to be avoided as an accompaniment of a critical operation. A blood-pressure apparatus I employ invariably during cranial operations, and the indication given thereby of the patient's condition from moment to moment is invaluable during serious operations. Everyone has his particular method of making an osteoplastic bone flap. I am not an advocate of the mallet and chisel, preferring a combined method with trephine, Dahlgren forceps, and Gigli saw, which enable one to elevate the flap in from fifteen to twenty minutes. A tourniquet about the head is always employed when possible, and this greatly simplifies the procedure. With the ingenious Stellwagen trephine I have had no experience, but can foresee many disadvantages from an instrument which must cut in an absolute circle and, at times, through bones of varying degrees of thickness. Finally, for those who anticipate doing operations upon the central nervous system, I believe that their training should be gained from experimental work upon animals. Only in this way can familiarity with the handling of brain tissue, the controlling of hemorrhage from cerebral vessels, cortical stimulation, and safe methods of extirpation be properly learned. Intracranial manipulations must be conducted in ways quite different from those followed in the management of tissues elsewhere.

It seems to me that there should be no wide divergence between the points of view of neurologist and surgeon, provided that the latter's interest does not lie solely in the mere operative procedure. Modern methods of osteoplastic resection, improved methods in diagnosis, and localization, toward which Dr. Mills' recently published scheme helps not a little, will all tend, first, to lower the mortality from the operation; second, to give

temporary relief to those unfortunate cases of inaccessible tumor, and, lastly, to increase the possibility of localizing and so of removing a greater number of actual tumors.

Dr. W. W. Keen: I quite agree with Dr. Mills in the importance of mapping out the areas of brain before any formal operation is attempted. While I have usually of late adopted the Kroenlein method, I think the individual method is of very much less importance than the actual fact that on the skull before the operation is done the line of the fissure of Rolando and other special fissures involved shall be marked, and especially the area where the trephine or the chisel shall be applied, so that there will be no doubt in the mind of the surgeon at the moment when he begins operation as to the exact position and size of the opening that he is going to make. The large osteoplastic flap in one sense renders exact localization of the various fissures or sulci of less importance than formerly; but what Dr. Mills particularly and rightly emphasizes is that the exact surgical area involved should be marked invariably. As a general rule the osteoplastic method can be employed, and it is vastly superior to any other. When the circumstances allow the use of it, I think the Stellwagen trephine the best. I like it much better than the dental engine or electrical saws. The difference between the dentist's use of the dental engine and my use is that he is using it every day all the time, and gets a muscular balance and an exactness of manipulation that I cannot obtain when I use it only occasionally. This is one reason why after some little trial of the dental engine I have practically given it up. When you come to the trephine, that of Stellwagen is certainly the best, the most rapid, and it gives you the largest sweep. There are cases in which the trephine cannot be used. In my clinic at the Jefferson College Hospital a month ago there was a man who had fallen, striking directly in the centre of his forehead. Presumably there was fracture of the cribriform plate, because there had been hemorrhage from the nose and mouth, followed by anosmia. I wanted to expose the frontal lobes on both sides, and began my incision 1 cm. above the orbital border on each side, and 4 cm. from the middle line. These two incisions were 6 cm. long, and were joined above by a cross-cut 8 cm. long. If the Stellwagen trephine had been used the narrowest part of the opening would have been at the base of the brain, and that was just where I wanted the widest opening. Another reason for making the opening with the chisel was that I could thus avoid any danger of hemorrhage from the superior longitudinal sinus until I was all ready to open my flap in a moment. I chiselled around the entire three sides of my flap with the exception of about one-half inch in the middle. At this point I chiselled through the inner table as the very last step, so that if hemorrhage took place I would be able instantly to turn the flap down and check the hemorrhage by pressure.

I am not afraid of concussion from the chisel and mallet. For a long

while I would not use the chisel because of that very fear, but a very considerable personal experience has never shown me the first case in which I judged that any damage followed the concussion from the use of the mallet. The enormous experience of many surgeons, especially in Germany, is to the same effect. I remember the remark made by Professor Chiene, of Edinburgh, that a surgeon in using the chisel for the purpose of opening the skull does not use the mallet and chisel as a carpenter, but as a sculptor. Consequently, the concussion is very slight, and I have long since abandoned any fear of damage to the brain in consequence of it.

The limits of interference with the brain are very much larger in some respects than we anticipate. I had about two years ago a case on which I operated for Dr. Dercum, which proved to be endothelioma of the Gasserian ganglion. At the second (intradural) operation I scooped out at the apex of the petrous portion of the temporal bone a cavity as large as the last joint of my thumb. With a broad spatula I lifted the brain, and was able to see the inner border of the tentorium through which the pons emerges. The other day, in rehearsing the operation, I was able in the cadaver to see this again with perfect ease, and even the root of the fifth nerve passing into the pons, and was able to pass in a pair of scissors and divide the latter. Horsley, in his earlier operations, divided the sensory root and avulsed it from the pons, but he opened its canal back of the Gasserian ganglion. So far as I can judge by the two experiences, the one operation upon the living and the other upon the cadaver, I should not think it necessary to open this canal, which adds to the risk of the operation. If you can lift the base of the brain and see the sensory root (as one can quite readily, I am convinced), you could then divide the sensory root with a pair of scissors perfectly well. On the cadaver I have divided the tentorium posterior to the ridge of the petrous portion of the temporal bone through which runs the superior petrosal sinus, thereby avoiding any danger of hemorrhage from it, and I have exposed the anterior portion of the cerebellum.

Dr. Frazier has divided the sensory root of the fifth nerve extradurally just behind the ganglion, and I believe that he was at first able to do this, conserving at the same time the motor root. In his second attempt the motor root was torn. Not long since I operated on a case for tic douloureux which required the same operation. I attempted Dr. Frazier's operation, with his kind co-operation, but neither he nor I nor any of the assistants was able to see the motor root and recognize it as such. This may have been an exceptional instance, and that in most instances it can be readily distinguished. I felt, however, that it was so absolutely important that the entire sensory root should be divided, so that the patient should have no recurrence of pain, that had I even recognized the motor root I would have divided it if there had been the least doubt as to entire division of the seusory root. If, however, one can lift the base and catch the sensory root

just within the crescentic edge of the tentorium as the root emerges from the pons, it might possibly be divided without serious hemorrhage. It can be divided much nearer the pons in this way than in any other, and I believe that it will shorten the operation and reduce the hemorrhage, and so reduce very much the mortality.

Dr. W. Joseph Hearn: I have had the opportunity of opening the skull by the large trephine. When it is desired to take off intracranial pressure it is a very good measure, but you cannot replace bone, and it takes a long time to make a four-inch opening in the skull. I have also used the chisel, and when it is necessary to use it for a long time I believe there is some concussion. I have used the Stellwagen instrument, completing the opening in from twenty down to fifteen minutes. I believe it is the better method where it can be employed. There is less hemorrhage, and the bones can be accurately replaced. While I use ether and not chloroform, there is always shock in prolonged etherization, and this is lessened by the use of the Stellwagen instrument. When I want to make an osteoplastic flap, which I believe is the only right way of getting at a tumor of the brain, I prefer the Stellwagen instrument, which is practically that of Dr. Da Costa's.

Dr. F. X. Dercum: Dr. Mills has spoken of the mistakes neurologists make in localization. I think frequently we make the serious mistake of overlooking the presence of a tumor because of the frequent concurrence of symptoms of hysteria. Years ago hysteria was so little recognized in this country that it was often spoken of as a French disease of which we saw little or nothing in America. As a matter of fact, an increasing familiarity with its symptoms has shown that it is the most common disease met with in our public clinics next to neurasthenia. We have also learned that its simultaneous existence with true organic nervous disease is a very common occurrence. In brain tumor, for instance, hysteria is sometimes pronounced. One of the most interesting experiences I have recently had was in the study of a case of tumor of the brain with Dr. J. C. Wilson and Drs. Mills and Spiller, in which there was a transient hypæsthesia of the entire left half of the body, together with contracted visual fields. There was, however, present a hypæsthesia in the trifacial distribution upon the same side, and this, together with other symptoms, led the diagnosis to brain tumor, the existence of which was confirmed by operation.

Dr. Cushing has spoken of the wisdom of trephining for the relief of pain. Dr. Keen will recall a case in which an extensive opening was made over the cerebellar region, with marked relief of symptoms. I myself am emphatically of the opinion that when pain is very great, operation for the relief of this symptom alone is perfectly justifiable.

I share with my friend Dr. Mills the conviction that no case of brain tumor is conclusively studied without the use of the Röntgen rays; but, on the other hand, I do not overestimate the value of the rays. Not infrequently plates made under exactly the same conditions reveal slight

differences in shadows which are difficult to explain. When, however, the shadows are definite and confirmed by repeated exposure, and further, when they are in keeping with the neurological localization, they are of value. Of themselves, I think it is still to be proven that they can be relied upon for definite localization of lesions.

Speed in an operation is one of the essentials to success, and I regard for this reason the Stellwagen instrument as one of decided value. When hemorrhage is marked it has seemed to me wise to defer the conclusion of an operation to another occasion. The temptation to take out a tumor when it is once discovered is very great, but I believe our success would often be greater if we would first elaborately control bleeding, as by the ligation of all the vessels in the immediate neighborhood of the growth and by other means control the hemorrhage. I agree entirely with Drs. Keen and Mills in regard to the value of the osteoplastic operation. I believe it is better than all other methods, but is not always applicable, as, for example, in operations at the base of the brain.

Dr. J. Chalmers Da Costa: It is very gratifying to observe the growing enthusiasm of our neurological brothers in the field of surgery, for we have been accustomed to see them occupy the place of the rather superior scoffer. I do not think it necessary that the neurologist should study surgery, but do consider it necessary that the surgeon should study, at least, a little neurology. Dr. Mills is to be congratulated upon the number of his successes in locating tumors. Von Bergman believes that the location is erroneous in 70 per cent. of cases. Mills effected successful localization in 18 cases out of 20. Statistics show that only a small number of brain tumors are removable. They also indicate that some irremovable tumors might have been removed had they been recognized early.

We divide operations into palliative and radical; but, after all, any operation that is not distinctly palliative is exploratory, because of necessary uncertainty as to location and limitation. It is, therefore, important that we should have large exposures, and I am a positive believer in the value of the osteoplastic flap. The palliative operation is often of very great value, and has been warmly advocated by many distinguished surgeons and neurologists. It may arrest such direful conditions as advancing blindness, may relieve headache, and may postpone the inevitable evil day. We should remember that all tumors, unless they be syphilomata, are necessarily fatal lesions, and that even syphilomata often are. Therefore, we are justified in doing a more positively radical operation than when dealing with a lesion which is not in itself of necessity mortal. Iodide of potassium and mercury have often been beneficial in syphiloma and other growths, but reliance on them has often caused disastrous delay. Horsley says that three months should be the limit of persistence in the administration of mercury and iodide; Keen says six weeks. I think that without very positive evidence of improvement we ought never to persist in the administration of these drugs beyond some definite and moderate time limit.

Regarding the use of the X-rays, I saw a picture of one of Dr. Mills' patients before operation. I, being then a scoffer, suggested that it might be a picture of a mental thunder-storm. And yet in this case operation disclosed a tumor in the position indicated by the picture.

The anæsthetic in tumor cases is sometimes a powerful predisposing cause of death. Particularly in cerebral tumors, sudden death during operation may occur, especially when the finger is inserted to explore.

In the use of the chisel and mallet, I believe that the concussion must be harmful and that the hammering does affect the circulation.

When we look at the comparatively recent statistics of Ferrier we must take comfort and conclude that operations for tumors of the brain are not only justifiable, but are often of distinct value. Ferrier tells us that the existing mortality is 36 per cent. This ought to be diminished by the knowledge of the necessity of care in giving the anæsthetic; growing rapidity in operating, and by the increase of power to prevent and to arrest hemorrhage. When we consider that in 13 per cent. of cases definite and positive recoveries are obtained, the view is at least encouraging.

Dr. Charles H. Frazier: There is only one point to which I may call attention, viz., with reference to that class of cases in which, as Dr. Mills said, the cause of death is unknown. Probably 25 per cent. would be considered a conservative estimate of patients who die immediately from the effect of operation. In some cases death is attributed to shock, in some to concussion, and in some to "unknown" causes. I am inclined to believe that in the latter class of cases death is due to the sudden withdrawal of intracranial pressure. It is well known that the brain can be subjected to a certain amount of intracranial pressure without any serious consequences; it is furthermore known that there is a rise in the blood pressure, compensatory in character, compensating for the disturbance to the cerebral circulation consequent upon the increased pressure. Recent investigations of Kocher and his students have demonstrated that the sudden withdrawal of intracranial pressure, after the blood pressure has been forced to a considerable height, may be followed by paralysis or breakdown of the vasomotor mechanism, resulting in death.

If we are right in assuming that this theory will explain many of the fatal terminations in a given number of cases, should we not give more serious consideration to that modification in the technique of operation on brain tumors which calls for the division of the operation into two stages. Horsley recommended the adoption of this procedure in every case without exception, and Von Bergman, though not going so far as Horsley, recommended the two-stage operation in cases in which the patient's general condition was below par, or in which the tumor was a particularly large one; but surgeons at large do not approve of or at any rate do not practise Horsley's method. I believe, however, that it is deserving of very serious consideration, and should be practised for a length of time and upon a number of cases sufficient to determine its effect upon the mortality.

EXHIBITION OF AND REMARKS UPON SOME NEW INSTRUMENTS.

By W. W. KEEN, M.D.

[Exhibited November 5, 1902.]

Mikulicz's Œsophagoscope; Michel's Instrument for Uniting the Skin by Means of Metallic Clamps Instead of Sutures; Cathelin's Instrument for Obtaining the Urine from the Two Kidneys Separately.

The large case is of this size for filling with water, in order to keep the instrument warm. In two instances in which I saw Mikulicz use it he was able to introduce the instrument into the œsophagus, passing down beyond the cricoid cartilage, which is the only physiological obstacle to its introduction. The patient is placed in the right lateral position, with the left hand free to be raised in case of pain. Mikulicz is careful not to pass the instrument in cases of carcinoma high up. It has occurred to him once and to a surgeon in Vienna to perforate in high carcinoma, and both patients died. There are long swabs to free the tube from any accumulated fluid, and a number of other instruments for seizing foreign bodies or obtaining small pieces of a neoplasm, which I show you.

The second instrument was devised by Michel to avoid the marks on the skin of the neck, face, and hands produced by the sutures as we ordinarily use them. It is comprised virtually of two pairs of forceps, one for the purpose of catching and approximating the margins of the skin, and the other for the purpose of pinching the ends of the clamps together. There are little clamps carried on one blade of the first-mentioned forceps, each one taken off in turn by the other forceps. The clamps are of flexible metal, with a little prong toward each end. These minute prongs catch in the skin and hold it.

The third instrument seems to me the most practical means of determining the existence of disease of either of the two kidneys by the character of the separate urines.

Its use will also give us positive evidence of the existence of functional activity of the other kidney in case of a possible nephrectomy.

It consists, first of all, of a staff which has on each side a fine tube carrying a small catheter for drawing the water of each kidney separately. A concealed movable bar and handle carry a fine watch spring shaped like a tennis racket and covered with thin rubber dam. This is to divide the bladder vertically into two halves as an artificial septum. The capacity of the bladder is measured before the instrument is introduced. There is a scale showing exactly how far the artificial septum is to be introduced, and then drawn back until it reaches the neck of the bladder. I saw Cathelin use the instrument in his clinic. In one case within five minutes the specimens of urine showed one perfectly clear and the other sufficiently bloody to indicate distinctly from which side the blood came. The difficulty with Harris' instrument is that it is frequently exceedingly painful. Of the two patients upon whom I saw Cathelin use the instrument one complained a little of pain, which was exceptional, and the other one of absolutely no pain whatever.

A STUDY OF THE EXCRETION OF UROBILIN AND OF SOME OF THE ENTEROGENOUS DECOMPOSITION-PRODUCTS IN PREGNANCY AND THE PUERPERIUM.

By DAVID L. EDSALL, M.D., IRA B. WILE, M.D.,[1]

AND

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We shall confine ourselves, in this communication, to a short statement of the purposes of our investigation and of the results obtained, since the details cannot be successfully given in full in such a brief space. The methods used and the important details will be mentioned elsewhere.

Merletti recently directed attention to the common occurrence of urobilinuria in pregnancy, and reported that he had found it so constantly that he considered it to deserve the adjective physiological. He also said that an intense urobilinuria follows death of the fœtus, and that, consequently, an extreme degree of urobilinuria in pregnancy constitutes an important sign of death of the fœtus. Other observers have likewise noted the frequency of urobilinuria in pregnancy, and, in some preliminary observations, we, too, found it common.

We undertook a systematic study of the frequency and intensity of this urobilinuria and of its relation to the excretion of the products of intestinal decomposition, with a number of objects in view.

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Before mentioning these objects the current ideas concerning the source and meaning of urobilinuria may be briefly stated as follows:

Urobilin is probably always, certainly nearly always, derived from bilirubin by reduction in the intestines; and this reduction appears to be chiefly, or entirely, the result of bacterial action. Only extremely small amounts are normally passed in the urine, but in conditions associated with excessive blood-destruction (severe progressive anæmias, internal hemorrhages, etc.), in numerous infectious diseases, and in many cases of disease of the liver the amount of urobilin excreted in the urine becomes excessive. In the first class of conditions mentioned the increase is considered to be due chiefly to increase in bile-formation, resulting from the excessive blood-destruction. In the second class the urobilinuria may, perhaps, be explained in the same way; though this is not definitely true. In the third class, however, there is a direct relation to disorder of the liver; and this class is relatively so large and so distinct that there can be no question that urobilinuria is often dependent, to a large extent, upon actual disease of the liver or disturbance of the function of that organ.

Urobilinuria does not occur exclusively in any one form of liver disease, however; and it is at present not possible to state whether urobilinuria, when occurring in liver disorders, means a disturbance of the formation of bile or of the more complex functions that are concerned in the transformation of substances foreign to the organism which reach the liver from the digestive tract. One theory maintains that it is the result of the secretion of a kind of bile that forms urobilin more readily than is normal. The chief opposing theory is that urobilin is normally transformed into some other substance in the liver; that, under certain circumstances, this function of the liver fails and that the urobilin then enters the general circulation and is excreted through the kidneys. Other theories maintain that it is actually formed in the liver, or attribute its formation to the action of the kidneys or of other tissues and bloody fluids. These latter theories may be correct in isolated instances; as a rule, however, urobilin is certainly formed in the intestines.

Its appearance in the urine in excessive amounts may, therefore, mean pathological alterations in the functions of the liver, excess-

sive destruction of blood, or, perhaps, simply pathological changes in the decomposition-processes occurring in the intestines. It is not well determined in any class of cases which of these conditions is immediately active in the causation of the urobilinuria, even though the main feature of the disease, such as excessive hæmolysis, be known.

One of our main purposes, therefore, was to determine whether urobilinuria shows a constant relation to excessive excretion of the most important of the common enterogenous decomposition-products and to see whether this possible relation is such as to indicate that bile-formation, abnormal intestinal decomposition, or the function of the liver that is active in transforming substances before their entrance into the general circulation and their excretion, is at fault. A number of enterogenous decomposition-products were studied coincidently, in order to see whether urobilin bears any important relation to one or more of them and not to others; and especially to see whether subsequent similar studies of cases of evident hepatic disorder would show any facts of importance in the diagnosis of disease of the liver. The urobilinuria of pregnancy and the puerperium seemed to furnish particularly useful material for a preliminary study of these questions, because numerous cases of this kind can readily be selected in which there is marked urobilinuria in persons that present practically identical general conditions and that show an absence of any definite local or general disease—especially an absence of excessive blood-destruction, of gastro-intestinal disorder, and of evident disease of the liver. Such conditions are difficult to find in other varieties of urobilinuria.

Another purpose was to study the question whether the excretion of excessive quantities of decomposition-products is direct evidence of gastro-intestinal disorder, or whether it may, as certain authors insist, mean equally well that the detoxicating power of the organism is imperfect—*i. e.*, that the excretion of excessive quantities of these enterogenous decomposition-products may often be evidence of general metabolic disturbance and inability of the tissues to destroy these substances, rather than a sign of their excessive formation.

A further purpose was to add to pre-existing knowledge concerning the relation of the different enterogenous decomposition-products to each other. It has already been definitely indicated that the

excretion of the different substances by no means runs parallel, and that the investigation of one of these substances—for instance, indican—does not at all clearly demonstrate whether all decomposition-products are normal, increased, or diminished.

Finally, there is a wide-spread belief that toxic symptoms in pregnancy and the puerperium, including eclampsia, bear a close relation to gastro-intestinal decomposition-processes; and it is even taught by many obstetricians that eclampsia is, at times, at least, due to gastro-intestinal autointoxication; this teaching having had, however, very little support in actual demonstrated facts.

We also wished to see whether the intensity of urobilinuria bears any relation to the occurrence of eclampsia or severe renal disturbance, and whether its presence would be of any importance in the prophylaxis of these conditions or at least in anticipating their early occurrence.

We investigated the conditions in 64 women, making from 1 to 4 complete examinations of the twenty-four hours' urine in each case, in one case of special interest 15 examinations having been made. Altogether, 123 full examinations were carried out. In each instance we determined the intensity of the urobilinuria by Riva's method. We also determined, quantitatively, the preformed and ethereal sulphates, the volatile fatty acids, the ammonia, and the total nitrogen, and made qualitative tests for indican, phenol, and acetone (each of the latter by testing the distillate), and observed the intensity of the reaction for these substances, if present.

The women were all in the maternity pavilion of the University Hospital; they were all living in identical circumstances; and, while it was not possible to keep the diet in individual cases constant from day to day, they were all furnished the same food, and there were no variations in the diet that were of great consequence. Except in cases that will be specifically mentioned, the women investigated showed no signs of any disease and no functional disturbance other than constipation, which was frequently present. The condition of the bowels was regularly noted in all the cases, since this is probably of some importance in relation to urobilinuria, and is certainly of importance in relation to the excretion of enterogenous decomposition-products.

In the first place, it may be stated that more than half the cases showed a very distinct excess in the excretion of urobilin. In about one-quarter of the cases this urobilinuria was so pronounced that a decided band was observed, even when the chloroform extract was diluted at least once, sometimes even as much as four times. These results were not dependent upon mere concentration of the urine. The work was, to be sure, done in hot weather, and in a considerable number of cases the amount of urine was small; but in more than half the cases the quantity passed was over 1000 c.c. It may, therefore, be stated that urobilinuria is common in pregnancy and the puerperium; but that it certainly is not constant, and cannot properly be called physiological. It is therefore, an evidence of some form of disturbance of the organism.

As to its relation to death of the fœtus: In one case—a syphilitic subject—a macerated, dead fœtus was delivered, and in this case there was an intense urobilinuria. In a number of other cases, however, an equally intense or even more marked urobilinuria was noted; and in one further case a dead fœtus was born, while urobilinuria was not present in the urine of the mother. While, therefore, it is not improbable urobilinuria frequently occurs with death of the fœtus, it can certainly not be considered a good sign of this accident.

As far as our observations have gone they indicate that urobilinuria appears late in pregnancy, although we are unable to speak definitely upon this point, as all but four of our cases were examined within a few weeks of term. The four exceptional cases mentioned were all in the fifth month. In none of them was urobilinuria present.

Urobilin when present in excessive amounts usually persisted in large amounts during the early stages of the puerperium. In a large proportion of cases it disappeared before the women were discharged from the maternity. In some of the cases, however, it was still present, although usually in reduced amount.

In the series there were two cases of eclampsia and two of marked albuminuria with casts. In all four of these cases the signs of kidney irritation disappeared completely and quite rapidly. One of the cases of eclampsia occurred in the fifth month; the other,

at term. The two cases of severe albuminuria were observed just at term. One case of eclampsia and one of albuminuria showed urobilinuria of intense degree. The other eclampsia case and the other albuminuria case showed an entire absence of any excessive amount of urobilin. Since, therefore, marked urobilinuria is very common, and since in the few cases observed it was not a constant accompaniment of kidney irritation or eclampsia, it would appear to be of itself of little value in the early diagnosis or in the prophylaxis of these conditions. In the two cases in which it did not occur, it seems to have been probably only a part of the evidence of flooding of the organism with intestinal decomposition products.

The results obtained in the investigation of the enterogenous decomposition-products were of more interest in this connection, and, perhaps, of more importance. All four of the cases of special interest (the two eclampsias and the two severe albuminurias) showed a very marked excess in the excretion of some or all of the decomposition-products; and it is of much interest to note that in each of these four cases the volatile fatty acids were decidedly above normal. It seems possible, therefore, from the results mentioned—and it is also rational to suppose—that abnormal decomposition-processes in the intestines, or inability of the tissues to perform their usual detoxicating function, may be an important factor in producing kidney irritation or eclampsia in pregnancy and in the puerperium. It is, of course, very questionable, especially in the light of the recent work concerning the possible cytotoxic origin of the eclampsia of pregnancy, whether this condition can be actually produced by an autointoxication of gastro-intestinal origin. It, however, seems well worth while to make further studies of cases exhibiting kidney irritation and cases of eclampsia in order to determine the frequency with which they are accompanied by the excretion of excessive amounts of enterogenous, decomposition-products, and, more particularly, to determine whether the estimation of these substances would be of any value in the early anticipation and prophylaxis of serious toxic symptoms. Even if eclampsia is due to a cytotoxin, a theory that is as yet far from being proved, it is probable that a previous persistent flooding of the tissues with other toxic substances may reduce the resistance of the organism to the cyto-

toxin. It likewise seems possible, for reasons that will be given, that excessive excretion of enterogenous toxic substances may be an indication of a general excess of toxic matters in the organism, rather than mere evidence of abnormalities of the gastro-intestinal tract. In that case excess in the excretion of these substances would, to a certain degree, be an indication of a general toxæmia, and the management of the general state of intoxication might be sufficient to prevent subsequent grave symptoms.

The importance of these suggestions can be determined only by a series of investigations of cases that actually develop signs of intoxication, and such work, with the methods at present available, is suitable only for those who have some laboratory equipment.

As to the relation of our work to the question of the meaning of an excess of enterogenous decomposition-products: There was, as stated, a very striking tendency, in most of these cases, to the excretion of abnormal amounts of some or all of these products. Large amounts of phenol were frequently met with; the indican reaction was very often intense; the total ethereal sulphates very commonly were found to be above 0.300 gm., in some instances even approaching 0.500 gm.; and the volatile fatty acids, in quite a large number of instances, rose as high as 120 gm. to 150 gm. (in terms of $\frac{1}{10}$ normal NaOH solution), though the last-mentioned substances, in the normal cases, showed far less tendency to excess than did the indican, phenol, and total ethereal sulphates.

At the same time, it was a very striking fact that there was absolutely no constancy in the relative amounts of these different substances excreted. As a rule, when a phenol reaction was obtained the indican reaction was intense, though there were, nevertheless, a few very marked exceptions to this rule. The total ethereal sulphates, while usually high when a marked indican reaction was obtained, and particularly when phenol was present, were sometimes rather low, even when indican was present in decided excess; and in a number of instances the amount of ethereal sulphates was quite low (in several instances, for example, it was below 0.110 gm.), in spite of the presence of a decided phenol reaction. These facts show very clearly that the study of the excretion of one

decomposition-product by no means determines whether the others are present in normal or in abnormal amounts.

We have frequently demonstrated this same fact in other cases, and have in a number of instances found the coincident study of a number of the decomposition-products to be of decided importance in determining the treatment. Some of the decomposition-products, as, for instance, the volatile fatty acids, we have repeatedly found very excessive when the others were normal; and treatment directed to the control of decomposition and to the furtherance of elimination soon cleared up obstinate and obscure symptoms. The indican reaction in these cases was often very slight. A very striking fact in a number of these cases was that gastro-intestinal symptoms were entirely absent.

The absence of gastro-intestinal symptoms in the cases just mentioned, together with the fact that the women whose conditions are presented in this communication showed very marked variations in the excretion of enterogenous decomposition-products from day to day, and in their individual persons as compared with each other (in spite of the fact that they were getting the same diet and living under identical conditions, and in spite of the fact that gastro-intestinal symptoms—even constipation—were frequently entirely absent when the excretion of decomposition-products was normal), lead us to assent to the view that in a large number of instances the excretion of these decomposition-products in excess means that the tissues have failed to break them down rather than that they have been actually formed in large excess. This view is entirely in consonance with the facts that have been determined in connection with certain other conditions, as, for example, acid intoxication in diabetes mellitus. It has been clearly shown that the occurrence of grave symptoms of intoxication in this condition are dependent chiefly upon the power of the organism to oxidize the acids, rather than upon the amount of the acids formed.

This view of the excretion of the decomposition-products may, we believe, justly influence one's view concerning the excretion of urobilin in excess. In our studies the intensity of the urobilinuria showed no regular relation to an excess of all the decomposition-products. In most instances there was, with marked urobilinuria, an

excess of some one or more of the decomposition-products, but there was no constant relation between urobilinuria and excess of any one special decomposition-product, and in a number of very striking instances there was an intense urobilinuria with very small amounts of decomposition-products of any kind in the urine. These facts seem to us to indicate that urobilinuria bears a close relation to intestinal decomposition-processes, but that it apparently bears no relation to any one form of decomposition-process—at least as indicated by the substances excreted in the urine.

This lack of constant relation to any of the recognizable forms of intestinal decomposition; the entire lack of evidence, in many of these women, of any gastro-intestinal disturbance (again including constipation), and the fact that the conditions of life and diet in the women were the same, make it seem improbable that the factors active in the excretion of an excess of urobilin produce their effects in the gastro-intestinal tract itself. As we have previously indicated, we believe it probable that the intestinal decomposition-products often show variations in excretion because they are not properly destroyed after leaving the gastro-intestinal tract. We think that a similar statement may, with propriety, be made concerning urobilin, and consider that this work indicates that the theory that urobilinuria is usually dependent upon lack of its alteration after leaving the gastro-intestinal tract is more probably correct than the theory that there are alterations in the intestinal decomposition-processes or in the quality of the bile furnished to the intestine.

A CASE OF GANGRENE OF THE LUNG CURED BY OPERATION.

By DAVID RIESMAN, M.D., A. C. WOOD, M.D.,

AND

G. E. PFAHLER, M.D.*

[Read December 3, 1902.]

The history of the case is as follows:

I. P., a negro, aged sixty-three years, born in Delaware, was admitted to my wards in the Philadelphia Hospital on July 22, 1902. His mental condition was such that a complete history was not obtainable; but it was ascertained that his family history was good and that his own health had always been satisfactory.

The illness on account of which he entered the hospital began four days prior to admission, with chill, pain in the right side, and cough. Examination showed the patient to be an emaciated man, with excessively tortuous temporal arteries, and hard, beaded radials; with arcus senilis and contracted pupils. His skin was hot and dry, the tongue coated, the breath offensive, the temperature 103.6°, the pulse 110, hard and incompressible, and the respirations 36. The chest showed diminished expansion on the right side. The percussion resonance was impaired over the middle of the right lung posteriorly and in the middle of the right axillary region. Over this dull area fremitus was increased. Auscultation did not afford any satisfactory revelations. The heart sounds were feeble, except for the second aortic, which was accentuated.

The temperature remained elevated—between 102° and 103.4°—for two days. During the night of July 24th it fell rapidly from 103° to 98°, five degrees, without any sweat. The respirations dropped to 28; the pulse to 88. Within a few hours, however, by 11 A.M., the temperature had again risen to 101.6°, declining by the following morning at 8 to 97.8°.

Examination at this time revealed very little of moment in the chest. No distinct area of consolidation could be discovered, and, judged by the physical signs, the man's condition had greatly improved. The symptoms,

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however, did not show a corresponding amelioration. Despite the fall in temperature, pulse, and respiration rate, the patient's state appeared grave. He was delirious and struggled to leave the bed, had insomnia, coughed a great deal, and passed urine and feces involuntarily. During the time in which the quantity of urine was measurable, it was from twenty-two to thirty ounces; it contained albumin and an abundance of hyaline and granular casts; was acid in reaction, and had a specific gravity of 1020. The bowels were loose, greenish in color, and very offensive. There was no enlargement of the liver or spleen.

The temperature remained decidedly subnormal for four days, between 96° and 98°, the highest point in the day being reached at either 8 P.M. or 2 A.M. Only once during the four days did it ascend above 99°. The breath was offensive, especially during coughing, and on July 28th the Resident Physician, Dr. Dalby, noticed that the sputum had a gangrenous odor. In a specimen examined at this time I was not able to find elastic tissue or fatty acid crystals. Tubercle bacilli were also absent from the sputum.

An examination of the chest made on July 28th showed the following:

Slight impairment of resonance on the left side in the first and second interspaces in front; a normal note elsewhere over the left chest. On auscultation, the breath sounds were found to be feeble over the entire left side, including the area of slight dulness. Here, however, the expiration was a trifle prolonged, but neither harsh nor bronchial. On the right side nothing was found in front; posteriorly, however, important physical signs were discovered. There was a dull patch to the inner side of the lower half of the vertebral border of the scapula, in the scapulovertebral space, the dulness extending downward and forward to just behind the postaxillary line. Over the dull area, especially in the spinal gutter, both tactile and vocal fremitus were increased. On auscultation, bronchial breathing could be heard over a small area inside of the lower half of the scapula, close to the spine, at the fifth rib. Below the angle of the scapula the breath sounds were normal, but became faint in the axillary region. The pulse was feeble and almost thready, the breath gangrenous. The patient was delirious and had to be restrained. Dr. Wood saw him with me at this time, and agreed as to the advisability of operation. The man was transferred to the surgical wards, and, at my request, Dr. Pfahler made an *X*-ray examination. Inspection with the fluoroscope showed impaired movement of the right half of the diaphragm, with a distinct shadow at the right apex. The lower portion of this shadow was on a level with the base of the spine of the scapula. A negative was made, which was developed while the patient was being etherized and prepared for operation. This exhibited more distinctly the area involved, and showed a dense wall surrounding a lighter area in the upper part of the right lung. The lower portion of this wall was on a level with the base of the spine of the

scapula, and apparently included all the lung space above this point. The patient moved during the exposure, and thus spoiled what would otherwise have been a good negative. Physical examination just prior to the administration of the anæsthetic showed, as before, a small patch of dulness and bronchial breathing in the area between the spine and the right scapula.

Guided by the physical signs and by the information furnished by the radioscopic examination, we were able to determine in advance just where to make the incision and which rib to excise, the fifth being the one chosen.

The following are Dr. Wood's notes upon the case:

"I saw the patient referred to in the foregoing report, through the courtesy of Dr. Riesman, on the 28th of July last. The most striking feature was the very offensive odor that was observed upon entering the room, which became more pronounced as the patient was approached. The odor that came from the man's breath was typical of gangrene. The other features that impressed me were the subnormal temperature and the confused mental condition of the patient. The result of the physical examination is fully detailed above. I had no hesitation in coinciding with Dr. Riesman in the diagnosis of gangrene of the lung and in the opinion that an early operation should be performed. The only point that seemed in doubt was whether the patient would survive the operation; but, as we felt that recovery was impossible by any other means, we considered it proper to give him this chance.

"The gangrenous area of the lung had been very carefully outlined by Dr. Riesman and Dr. Pfahler; and the latter had taken an excellent skiagraph which fully confirmed the location of the lesion as previously determined by physical examination.

"The operation was performed July 29th. Just before the anæsthetic was administered, Dr. Riesman again, at my request, outlined the area of dulness, which was on the level of the fifth rib, on the right side posteriorly, between the inner border of the scapula and the spine.

"Chloroform was administered until anæsthesia was complete, when ether was substituted. The skin was then cleaned in the usual manner, and the fifth rib exposed by a slightly curved incision, an inch and a half or two inches of it being resected by the subperiosteal method. The visceral and parietal layers of the pleura were found to be adherent and dark and lustreless in appearance. The gangrenous portion of the lung was found to be just beneath the pleura, so that no delay or difficulty was experienced in reaching it. Some fragments of necrotic lung tissue were removed. Digital examination showed the cavity to be as large as a man's clenched fist. It was not thought proper to irrigate the cavity, but the walls were gently cleansed with the aid of gauze sponges, which brought away all loose

dead matter. The cavity was then packed with sterile gauze, and the usual dressings were applied.

"The patient bore the operation very well, and did not seem any worse in consequence. The wound was redressed daily, the packing and any sloughs that appeared being removed, after which fresh packing was introduced. The discharge was very profuse at first. The breath rapidly lost its foul odor; and, although the wound remained very offensive for some time, it gradually lost this character. The delirium persisted for some days, but was less and less pronounced, and finally disappeared entirely.

"Instead of a subnormal temperature, which was present before operation, the temperature rose immediately, reaching 101°. The pulse was 112 on the evening of the operation. On the fourth day, the temperature reached 102.6°; pulse, 104. From this time both temperature and pulse gradually declined. Cough continued to be a prominent symptom, but became less troublesome. The general condition of the patient changed for the better in a very satisfactory manner.

"While dressing the wound it was noted that air was expelled violently when the patient coughed, showing that a rather large bronchus opened into the cavity. The volume of air thus escaping from the wound diminished continuously as the cavity healed."

August 24th a note says: "Patient still has cough, but otherwise is in a fair condition. Air still comes through the wound, but the probe shows that the cavity is decreasing in size. The patient feels well and wants to sit up."

From this time on the convalescence was rapid and satisfactory.

Some of the points of interest brought up by this case are: First, the use of the X-ray as an aid in locating the pulmonary lesion. While the procedure is no longer new, another instance of its value is worth recording. Although the skiagraph confirmed the physical signs accurately, and in no way modified the treatment, it was very satisfactory to have this confirmatory evidence. It must be admitted that physical signs are sometimes misleading, and it is in these cases that the X-ray gives invaluable service. Tuffier (*Revue de Chirurgie*, August, 1901) advises that when skiagraphic findings do not coincide with the results of auscultation and percussion, the latter be ignored and the operation be done according to the evidence furnished by the former. He cites a case in which the skiagraph showed a lesion toward the base of the lung, while the stethoscope indicated a higher seat. The incision was made at the point indicated by the stethoscope, with negative results. The next rib below was then resected, and the focus was discovered in the place shown

by the X-ray. The same author reports eight cases in which he has applied radiography to pulmonary affections. The results were extremely satisfactory in five instances, and negative in three. In some pathological conditions the X-ray fails entirely, but gangrene of the lung has been found to cast distinct shadows. In accepting the X-ray evidence it is necessary to be assured of the fact that the plate is satisfactorily clear. If doubt exists, it is better to discard it altogether. In order to be as certain as may be, it is desirable always to have two skiagraphs taken, and to note whether they conform with each other.

The importance of definitely locating a lesion of the lung before undertaking any operative procedure will appeal to everyone. On this point Tuffier states that operations on the lungs when the lesion was accurately diagnosed beforehand were successful in 71 per cent. of the cases—that is, that the mortality was 29 per cent.; while the mortality was 60 per cent. in the cases in which there was a mistake in the diagnosis. Of 300 cases collected by this author the lesion was incorrectly diagnosed in 48.

The resection of a rib may be done under local anæsthesia if the condition of the patient will not warrant the use of a general anæsthetic; but in our case the delirious condition of the man made him an unsuitable subject for the former. When a general anæsthetic is necessary, chloroform is usually to be preferred.

The resection of ribs and the pleural opening should be ample in cases of pulmonary gangrene. This is more essential in these cases than in abscess of the lung, as the healing process is slower, and it is necessary to keep the external opening patulous until the cavity is entirely closed. With a liberal opening, also, the wound may be drained with gauze, which I believe to be more efficient and suitable in these cases than tubes.

When the parietal and visceral layers of the pleura are adherent the lesion may be opened immediately; but all operators agree concerning the desirability of securing this condition before attacking the lesion. When adhesions do not exist, therefore, the two layers should be stitched together around the proposed opening into the lung, which may be made at the end of forty-eight hours, or sooner, if the patient's condition demands earlier relief.

Some operators advise against irrigating the cavity in these cases, and with these I am in entire accord; others are equally convinced of the value of this procedure. Those who hold the latter view should follow the method advised by Cotterill: "The fluid should be a mild antiseptic (not carbolic lotion); it should be warmed to about blood heat; it should be injected slowly and without force, great care being taken that it runs out as fast as it runs in. The patient should be rolled over into such a position that it is impossible for a large volume of the lotion to collect in the chest at one time and, by its weight, embarrass the heart. . . . The fluids I prefer to wash out with are: boric lotion, a solution of creolin, or a solution of izal, the latter of which is a particularly useful deodorizer."

Herezel states that about one-fourth of all the recorded operations upon the lung have been for gangrene. Of 91 cases of pneumotomy for gangrene, 60 to 61 per cent. were successful. Garré reports 122 cases operated upon for pulmonary gangrene, of which 66 per cent. were cured. He states that but 20 or 25 per cent. recover without operation.

The patient's present condition is most satisfactory. He feels strong, his mind is clear, and he has become a useful helper about the ward. Physical examination shows a slight depression below the right clavicle. The percussion note is the same on the two sides in front, but is slightly impaired in the right axilla, and below the operative wound for a distance of one and one-half inches. Auscultation shows slightly harsher bronchial breathing over the right side, some increase in vocal fremitus resonance, and breathing somewhat harsher in the neighborhood of the wound—not extending more than an inch above this. The urine has a specific gravity of 1018, and contains a faint trace of albumin, but no casts. The man has gained between thirty-five and forty pounds in weight. There is a slight discharge from the sinus, but the indications are that it will soon be closed.

While the chief interest of this case centres in the happy results of the operation performed by Dr. Wood, there are several points of importance to which brief allusion will not be out of place. The first of these is the cause of the gangrene. The history of an acute onset during fair health, with chill, cough, and pain in the side, suggests that the primary condition was lobar pneumonia.

Why this so rapidly—apparently in less than ten days from the time of onset—passed into gangrene, cannot be answered, except in a speculative way. It must be remembered that the patient had pronounced arterio-sclerosis and albuminuria, conditions which, it is admitted by all, favor the development of gangrenous processes in the lung.

Lobar pneumonia is an accepted precursor of gangrene; but Anfrecht,[1] among 1501 cases, did not find it in a single instance—a most remarkable circumstance. He also cites Grisolle,[2] who, among 305 cases of pneumonia, found none followed by gangrene, and who, in seventy cases of pulmonary gangrene, was able to find only five in which the condition had supervened upon pneumonia. Osler,[3] however, observed it three times in 100 cases of pneumonia (3 per cent.), and according to Norris,[4] there were three instances of gangrene in 500 cases of pneumonia at the Pennsylvania Hospital—a proportion of 0.6 per cent. Tuffier,[5] in his collection of seventy-four cases, found pneumonia to be the etiological factor in more than thirty; and Pomeranzew[6] found five cases of gangrene among 727 of pneumonia.

In the only other case of gangrene that has come under my own observation—one that I did not see during life, but upon which I made the autopsy—the condition also followed lobar pneumonia. Other causes of gangrene that need merely be mentioned are embolism, the aspiration of foreign bodies and of putrid material from the upper air passages, wounds of the lung, tuberculosis, bronchiectasis, and the rupture of an empyema into the lung. Embolic gangrene has been observed after abdominal operations, in puerperal sepsis, as a sequel to middle ear disease, and secondarily to other abscesses and pyæmic foci. The fetid material that is the cause of aspiration gangrene may come from the pharynx; from the œsophagus, in cases of obstruction or rupture; or, as in a case reported by Packard and Le Conte,[7] from a bronchiectatic cavity. Gangrene also occurs as a rare effect of compression by aneurisms or tumors. Diabetes, typhoid fever, alcoholism, and—according to Gee and Herringham[8] —scurvy are predisposing causes of gangrene. It is probable that in the majority of cases of gangrene the system at large or the lung itself was previously in a state of lowered vitality.

The second point that I desire to emphasize is the absence of fever in our case. Fever, according to the majority of writers, is an important symptom of gangrene. Anfrecht[9] states that he has never seen it absent. Usually it is high—40° C. (104° F.) and over. At times it is remittent. As the temperature chart shows, the gangrene in our case pursued its course, not only without fever, but with a subnormal—almost a collapse—temperature. Pulse and respiration were equally unsuggestive of serious trouble, and it was only the man's general condition, his delirium and prostration, that made us feel that he was in grave danger. At the Philadelphia Hospital the opportunities for observing anomalous types of acute pulmonary disease are abundant. Only recently I saw a case of complete pneumonic consolidation of the left lung, typical at autopsy, and complicated with purulent pericarditis, in which there had been no fever.

The third point worthy of emphasis is the character of the sputum. As stated in the notes of the case, there was no elastic tissue, and fatty acid crystals were likewise absent. The odor, however, was characteristic of gangrene. In the diagnosis of pulmonary gangrene the sputum deserves careful attention. In typical cases it has a tendency to separate into three layers, the lowest consisting of globular masses with a tendency to confluence; the highest being frothy, and having masses of dirty sputum depending from its surface. The intermediate stratum is composed of a greater or lesser quantity of turbid, opaque fluid. When a part of the bottom layer is boiled with a 2 per cent. solution of potassium hydrate and examined microscopically on a slide, wavy bundles of elastic tissue are commonly found: but elastic tissue may be entirely absent. This fact is explicable on two grounds: First, the gangrenous process may have been arrested, the cavity no longer spreading; and second. the elastic tissue may have been dissolved by the fermentative action of the fluid—an action that is probably due to bacterial activity. It has been shown by Müller and by Simon, to quote an analogous instance, that the pneumonic exudate is dissolved by a proteolytic ferment. The fatty acid crystals are frequently absent. They are usually found in old cases of gangrene; ours was, of course, acute. In some cases of gangrene the sputum presents nothing peculiar,

and the destructive process in the lung is discovered only at autopsy.

An attempt has been made to differentiate the odor of fetid bronchitis from that of gangrene. Aufrecht compares the former to the smell of stale cheese, and the latter to that of the fluid of manure.

It is scarcely necessary to discuss the other diagnostic features of gangrene. The sputum and the fetor of the breath are, as Osler[10] says, the distinctive features. The important point is accurately to locate the involved area. When the gangrenous process is circumscribed, physical examination usually renders this possible; at least, it serves to focus attention upon a particular area in the lung. When, however, the process is more or less diffuse or the foci are multiple, accurate delimitation is difficult. In the circumscribed form, there may be the signs of a cavity or of a consolidation. When the symptoms are clear and physical examination gives but dubious results, a careful search should be made for the presence of râles, as their detection may be the only clew to the situation of the trouble. Errors are, however, frequent. Strange to say, the physical signs are likely to locate the focus either too high or too low; the latter is more often the case. Furthermore, they do not give an exact idea as to the depth of the gangrenous area beneath the surface of the lung; and they often fail to map out its actual size. Usually the gangrenous cavity is found to be much larger than was suspected. Gangrene has occasionally been mistaken for empyema, as in a case reported by Körte.[11]

Exploratory puncture naturally suggests itself as an aid in diagnosis and localization; but, on account of the danger of causing infection of the pleura, with consequent empyema or, by carrying the needle that has been infected by its penetration of the cavity through a healthy part of the lung, of producing a spread of the infection throughout the lung, exploratory puncture is better avoided. It is condemned by Lenhartz,[12] by Tuffier,[13] and also by Terrier and Reymond;[14] the last-named authors think it permissible only as a prelude to operation.

As has been pointed out by Dr. Wood, the X-ray is of great value in the diagnosis, as it usually indicates, with fair precision, the size and position of the gangrenous focus. Depending upon whether

the cavity is full or empty, there will be either a dark shadow or a light area in the affected region of the lung. In addition, the X-ray will show a lessened mobility of the diaphragm on the diseased side. I would suggest that in hospitals in which radiographic examinations can be made with facility, every case of acute lung trouble in which abscess or gangrene is a possibility be subjected to such an examination.

Prognosis. In acute forms of gangrene the prognosis is better than in those that are chronic. Metapneumonic gangrene has a decidedly larger percentage of recoveries than has gangrene due to embolism, aspiration, or bronchiectasis. In Tuffier's table of 71 cases, showing the relation of etiology to results after operation, there are 55 cases of gangrene following inflammatory affections of the lung, with 39 recoveries. There were 4 cases of bronchiectatic gangrene, with 1 recovery; 2 due to foreign bodies, with 1 recovery; 7 of the embolic variety, with 2 recoveries; 1 due to chest wound, with recovery; and 2 following perforation of the œsophagus, both ending fatally.

The mortality from gangrene without operation is necessarily very high—between 70 and 80 per cent. (Verneuill,[15] 80 per cent.). Under operative treatment the death rate falls to 34 per cent., according to Garré and Sultan,[16] who have collected 122 cases, with 80 recoveries and 42 deaths. In Eisendraht's[17] series of 28 cases of pneumotomy for gangrene there were 20 recoveries, 2 ameliorations, 6 deaths. One interesting feature alluded to by several writers is the apparently complete restoration of the diseased lung. In some cases reported by Lenhartz[18]—who has operated upon 25 patients for gangrene, 13 of whom recovered—physical examination and examination with the X-ray showed perfectly normal lung where previously there had been a large gangrenous cavity. That author gives it as his opinion that in such cases there must have been a re-formation of lung tissue. The second radiograph of our case also shows a restored lung. Whether there has been a true hyperplasia of air vesicles or merely an enlargement of the existing ones, it is not possible to say without experimental data.

All writers upon the operative treatment of gangrene refer to the importance of adhesions. Their presence greatly enhances the

chances of a good result; their absence predisposes to pneumothorax and to the entrance of septic material into the pleura, with resulting empyema. Lenhartz advises that if the condition of the patient does not demand immediate pneumotomy, this operation should be performed in two steps, the lung being fixed to the chest wall at one time, and opened later. When, however, the signs indicate that procrastination would be dangerous, it is best to open the lung without delay, care being taken to draw the organ into the wound and to stitch it, so as to guard against the occurrence of pneumothorax and empyema.

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DISCUSSION.

Dr. Ghriskey: I would like to ask Dr. Riesman whether any cultures were made. My experience has been to find gangrene of the lung due to the bacillus fœtidus.

Dr. Riesman: There were no cultures made.

GANGRENOUS CHOLECYSTITIS, WITH A REPORT OF A CASE IN WHICH A SUCCESSFUL CHOLECYSTECTOMY WAS DONE.

By JOHN H. GIBBON, M.D.,
PROFESSOR OF SURGERY, PHILADELPHIA POLYCLINIC; SURGEON TO BRYN MAWR HOSPITAL, AND OUT-PATIENT DEPARTMENT OF PENNSYLVANIA HOSPITAL.

[Read December 3, 1902.]

Gangrenous cholecystitis is a pathological condition sufficiently rare to warrant the report of every case. It may be looked upon as an extreme degree of phlegmonous cholecystitis, which is more frequently met with; but this condition usually results in death before a true gangrene of the gall-bladder is established. Robson, in the second edition of his book on *Diseases of the Gall-bladder and Bile Ducts*, speaks of gangrenous cholecystitis as "extremely rare," and says that he has been able to find but one case reported—that of Hotchkiss (*Annals of Surgery*, February, 1894). Robson, however, reports a case of his own which might be classed under this head. In the second edition of Kehr's book can be found no mention of a case of gangrenous cholecystitis. Mayo has, however, reported one case in which the gall-bladder was successfully removed (*Annals of Surgery*, October, 1899). Including Mayo's second series (*Annals of Surgery*, June, 1902), in which no such case is reported, it may be stated that there was only one case in 433 operations upon the gall-bladder and ducts performed by W. J. and C. H. Mayo. These statements show the great rarity of true gangrenous cholecystitis. Before discussing the condition I will briefly report a case in which the gall-bladder was successfully removed.

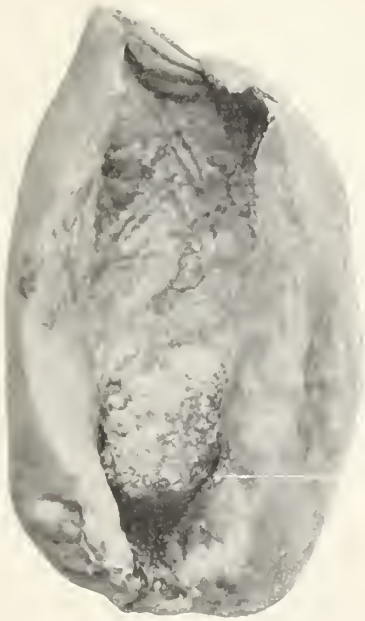
The patient, a woman, aged fifty-two years, was admitted to the Polyclinic Hospital on October 3, 1902. There was nothing in her previous history

worthy of note excepting that she had suffered from frequent attacks of indigestion, accompanied by nausea and vomiting. During these attacks she had been able to retain practically no food. The pain had never radiated to the shoulder, nor had the patient ever been jaundiced. Her present illness began three days before admission, with pain in the left hypochondriac region, and vomiting. These symptoms kept up intermittently. I saw the patient on the evening of October 3. At this time she had a temperature of 102°, pulse of 112, and respiration of 32. She complained of pain and tenderness on the right side of the abdomen, but these were less severe than they had been. The bowels were constipated. There was considerable rigidity of the abdominal muscles on the right side, but a tumor was palpable, which was smooth, and which seemed to move away from the examining hand. I was asked to see the case as probably one of appendicitis, but the position and condition of the tumor felt convinced me that the case was not one of appendicitis. The next morning a leucocyte count had been made and was found to be 37,600. At this time there was more tenderness and more rigidity, so much more, in fact, that the tumor could not be palpated. Immediate operation was determined upon.

When the patient was anæsthetized and the abdominal muscles relaxed it was easy to diagnose a distended gall-bladder. An incision was made over the tumor, and when the abdominal cavity was opened some free fluid was found in the gall-bladder region. The gall-bladder was covered by an adherent omentum, which, when removed, showed the organ to be distended and its entire fundus of a dark purple color. A number of large abdominal pads were inserted, the gall-bladder incised, and a quantity of very foul pus evacuated. The mucous membrane was green and gangrenous throughout. A large stone was found fixed at the mouth of the cystic duct. The whole fundus of the gall-bladder was gangrenous through all its coats. The line of demarcation between this and the remaining portion of the gall-bladder was well marked. This portion was quite thin, but the rest of the organ was very much thickened, measuring from one-half to one inch, as shown in the accompanying photograph.

It was decided to remove the gall-bladder, and its separation from the liver was easily accomplished by means of the finger, the tissues being soft from infiltration. No bleeding resulted from this separation. When an attempt was made to pass a ligature about the cystic duct the gall-bladder separated and came away. This took place when very little traction was being made upon it and before the first knot in the ligature was made, which well illustrates the condition of the organ even as low down as the cystic duct. The cystic artery bled freely and could not be controlled by a hæmostat, as the instrument cut through the inflamed tissues. Gauze packing was then introduced, and controlled the hemorrhage absolutely. A number of large gauze drains were inserted and the wound partially closed. The patient was very ill soon after the operation, requiring hypo-

dermoclysis, but her condition quickly improved, and the next day she was in fairly good condition. The convalescence was uninterrupted, the wound healing rapidly. An interesting feature in the convalescence, however, was the leucocyte count. This stood at 37,600 on the morning of the operation; the next day it had dropped to 12 600. The count then rose again to about 15,000 to 18,000, and finally gradually subsided. The patient was discharged from the hospital on November 14th, with only a small superficial granulating surface remaining. This subsequently entirely healed



The stone should occupy a lower position, but due to contraction of the gall-bladder it is not placed in its original position.

The etiology of gangrenous cholecystitis rests, probably, on two factors, obstruction of the cystic duct and infection by virulent micro-organisms. Whether either of these alone would produce it could hardly be proved, since in all cases micro-organisms are present and some form of obstruction, though it may result only from a swollen mucous membrane. It is hard to believe that gangrene of the organ could develop with a patulous cystic duct. Of course, gangrene of the gall-bladder does not occur until the inflammation has obstructed the circulation, and the fact that the gall-bladder is so well supplied

with bloodvessels saves it from gangrene, no doubt, in many instances. The pathological lesions of the gall-bladder closely resemble those of the appendix, but gangrene of the one organ is rare and of the other common, and in all likelihood this is to be attributed to the poor blood supply of the one and the free blood supply of the other. In the case reported the cystic artery bled freely when the gall-bladder was removed, and yet the entire mucous membrane and all the coats of the fundus were gangrenous. In this case I believe gangrene resulted from the firm impaction of the large stone at the mouth of the cystic duct, cutting off, when inflammation became well established, the circulation in much the same manner as an appendolith does in the appendix. The way in which the omentum was found spread over, and adherent to, the fundus of the gall-bladder reminded one of the way in which it so frequently surrounds a gangrenous appendix.

Of the symptoms it will suffice to refer to those presented in the above case. In brief, they are those of a violent localized peritonitis, with usually some temperature, persistent vomiting, obstruction of the bowels, and a high leucocyte count. Jaundice is not generally present, unless there exists a marked cholangitis, or unless the inflammation has extended by contiguity into the liver structure.

The diagnosis of this condition may be confused with that of appendicitis. When the anæsthetic is administered, however, I believe that the two conditions can be differentiated, and certainly immediate operation is equally called for in both. It would be a serious error to delay the opening of the abdomen in order to make a differential diagnosis between these two conditions.

The question of treatment probably ranks in interest next to the pathology. With the symptoms referred to no surgeon would hesitate to urge immediate operation exactly as he would in the presence of similar symptoms referable to the right iliac region, and I believe that precisely the same treatment should apply to a gangrenous gall-bladder as applies to a gangrenous appendix. Some authorities have in phlegmonous inflammation of the gall-bladder recommended and practised simple drainage. This may be good surgery when the stage of gangrene has not been reached or when the organ is small and contracted, and its removal might end in death from shock.

the result of a prolonged operation; but when the entire mucous membrane is gangrenous, and particularly when a portion of the whole thickness of the wall of the gall-bladder is gangrenous, total removal of the organ is called for, and to leave it would be comparable to leaving a gangrenous appendix which had been freed from all its adhesions and lay well separated from the abdominal cavity by gauze pads. To drain and leave such a gall-bladder means continued absorption, and probably an early death from sepsis. The relief following the removal of an organ in such a condition is well illustrated in my own case by the immediate cessation of symptoms, and a fall in the leucocyte count from 37,600 to 12,600 in twenty-four hours.

Regarding the technique of the procedure of cholecystectomy in the presence of inflammation of even a milder type than was here present, I am convinced that the advice of Mayo, who states that the cystic duct should not be ligated, is sound; and I am exceedingly glad that in my case the gall-bladder separated and came away before I committed what I now believe would have been an error. There must in all such cases be considerable cholangitis present, and nothing gives such relief in this condition or so quickly arrests it as external drainage.

DISCUSSION.

Dr. Richard H. Harte: I hardly like to allow this case of Dr. Gibbon's to pass without remark. It is one which is particularly interesting, and I congratulate Dr. Gibbon very much upon the result. There were some points brought out in dealing with these conditions which every surgeon occasionally encounters. Gangrenous cholecystitis is a comparatively rare condition; yet, looking at the specimen and noting the character of the stone it contained, I was struck with the idea that the gangrene which existed was in all probability due to the large stone, and probably ensued either from pressure or from the general inflammation around the part, cutting off the nutrition.

Upon the question of dealing with the condition, I agree with Dr. Gibbon that removal of a gangrenous gall-bladder is as imperative as the removal

of a gangrenous appendix. Although some authorities say this is bad surgery, I cannot agree with them; I believe the gangrenous mass should be removed. To drain it, to isolate it from the rest of the surrounding tissues with packing, etc., is a very uncertain way of dealing with these conditions. I think its entire removal is very much safer than to attempt to wait for nature to take care of the condition.

Furthermore, I congratulate Dr. Gibbon upon reporting the case and showing us the specimen.

APPENDIX.

ABSTRACT OF THE REPORT OF THE COMMITTEE ON MÜTTER MUSEUM, 1902.

During the past year nearly 400 specimens were added to the Museum, as follows:

Moist Gangrene of the Forearm. Presented by Dr. W. J. Taylor.

Fibrous Tumor of the Uterus; Extra-uterine Gestation; Appendix. Presented by Dr. J. M. Baldy.

Twenty-five Specimens of Vesical and Biliary Calculi. Presented by Dr. Geo. W. Norris.

Fibrous Tumor of the Uterus. Presented by Dr. G. E. Shoemaker.

Two Specimens of Vesical Calculi. Presented by Dr. J. B. Roberts.

Old Thermometer. Presented by Dr. A. V. Meigs.

Urethral Calculi. Presented by T. S. Westcott.

A number of interesting specimens of primers used in the American Army and Navy during the War of the Revolution, War of 1812, and Mexican War.

A Death Mask of the late Prof. Leidy. Presented by Dr. Jos. Leidy.

A collection of Nasal Instruments, a wooden Manikin to illustrate acupuncture, the moxa, and massage, with accompanying description. Presented by Dr. W. W. Keen.

A collection of Photographs and Autograph letters of 340 Fellows of the American Surgical Association from its origin to the present time. Presented by Dr. J. B. Roberts. Dr. Roberts states that it is his intention to keep up the collection.

During the year the Museum has been used for demonstrations to students by Prof. W. L. Rodman, Prof. H. A. Wilson and Prof. A. B. Randall.

In December of last year the Pathological Society held an exhibition in the Hall and the adjoining rooms of the Museum. In the Curator's Room an interesting demonstration was made by Prof. W. L. Coplin with the Projectoscope, and on the floor of the Hall an exhibition was afforded of

Pathological and Microscopical objects. A similar reunion of the Society will be held during the present year.

In December, 1901, the Mütter Lecture was delivered in the Hall of the College by Dr. Harvey Cushing, of the Johns Hopkins University, and was largely attended. The subject was: "Some Experimental Observations Relative to the Surgery of the Nervous System." The lecture for 1902 was delivered on December 2 by Major and Surgeon Louis A. Lagarde, U. S. A., on "Poisoned Wounds by the Implements of Warfare." A large audience was present.

In the last fiscal year the Museum specimens on the Hall floor and galleries have been rearranged and relabelled and numbered. Each label bears the catalogue number, case, and shelf of the specimen on which it is placed. Immediate easy access is thus afforded to every subject, and as the cases are numbered in large, distinct figures, the exact position of every specimen can be instantly recognized by anyone standing in the middle of the Hall floor. The desired specimens can thus be taken out for examination and demonstration. Afterward, and this is equally desirable, they can be accurately replaced in their proper position and the integrity of the Museum for reference may be continuously preserved. A card index of the Museum collection, with descriptive text, is now in progress and will be pushed to completion as rapidly as possible.

The committee cannot close its annual report without expressing their deep sorrow at the recent death of their late colleague, Dr. Frederick A. Packard. They wish to put on record their sense of his moral qualities and profound professional attainments. Especially do they desire to express their sincere appreciation of his faithful services to the College and of the loss which the committee has sustained by his untimely death.

SUMMARY OF THE REPORT OF THE LIBRARY COMMITTEE FOR 1902.

THE number of volumes now in the library is 67,243, an increase during the year of 2327.

The General Library contains	50,829
The Lewis " "	13,106
The Gross " "	3,091
The Library of the Obstetrical Society contains .	217

None of these are duplicates except 1505, which are retained as "reserves" to supply the place of journals and other much-used books when they are worn out. There are in addition 1357 duplicates on hand, which will be disposed of by sale or exchange as rapidly as possible.

In addition to the volumes reported above, there are more than 70,000 unbound reports, transactions, theses, and pamphlets.

The library receives regularly by purchase or exchange 394 medical periodicals, 86 American and 308 foreign, 38 more than at date of last report, and in addition 282 American and 104 foreign current numbers have been presented, chiefly through the courtesy of the editors of medical journals.

One thousand and sixty inaugural dissertations have been received during the year.

We now exchange publications with thirteen foreign medical schools. Two of these were added to our list by the efforts of Dr. Keen during his recent trip abroad, and he has been in communication with five others, with which he thinks an exchange can be arranged.

Thirty-eight journals were added to the subscription list during the year, and thirty-three volumes have been purchased for the completion of imperfect files.

There were 244 donors to the Library, of whom each of the following presented twenty-five volumes or more:

Family of Dr. William F. Norris . . .	1177 volumes.
Dr. George W. Norris	167 "
Dr. John T. Carpenter	99 "
Dr. H. A. Hare	78 "
Dr. F. D. Patterson	52 "
Dr. C. K. Mills	44 "
Dr. H. W. Stelwagon	41 "
Dr. A. H. Cleveland	26 "
Dr. H. H. Kynett	26 "
Dr. Francis R. Packard	25 "

The Library is also indebted to many of the Fellows for great numbers of journals and pamphlets and to the publishing houses of:

W. B. Saunders & Co. for	32 volumes.
P. Blakiston's Son & Co. for	18 "
J. B. Lippincott Co. for	13 "
F. A. Davis Co. for	8 "
Lea Brothers & Co. for	3 "

The Library has purchased from the:

	Vols.	Cost.
Henrietta Rush Fales Baker Fund	66	$240.04
William T. Carter Fund	27	243.87
John D. Griscom Fund	91	225.62
William F. Jenks Fund	44	184.50
Oliver A. Judson Fund	12	56.52
Wm. V. and John M. Keating Fund	11	34.38
W. W. Keen Fund	13	64.53
Library Endowment Fund	113	662.38
Weir Mitchell Fund	35	285.49
Philadelphia Medical Society Fund	9	12.42
Lewis Rodman Fund	33	232.28
J. F. Weightman Fund	5	41.54
Caspar Wistar Fund	12	79.02

And from the following special accounts:

Fund for completing files of journals	33	197.51
Journal Association	19	108.00
New Book Fund	37	119.56
J. Ewing Mears Account	24	74.72
S. D. Gross Library	18	91.44

Thirty-one of the new publications added to the Library were written or edited by Fellows of the College.

The number of visitors, or rather visits, to the Library during the year was 4967, an increase over the previous year of 371; 17,226 books were furnished by the Librarian for use in the Library, 4764 more than in 1901, and 6784 more than in 1900, and this does not include the large number taken directly from the shelves by Fellows who have access to the cases; 3041 books were taken out, an increase of 485. These figures are highly gratifying, as showing the value of the Library to the profession and the rapidly increasing use of it.

The current cataloguing is proceeding satisfactorily, all accessions of new books and more important pamphlets being catalogued as soon as received; but there are more than 2000 volumes from the libraries of Drs. Da Costa, Ashhurst, Hough, and Norris which it has been as yet impos-

sible to find time to catalogue. The work on revision of the catalogue during the year, though of necessity rather slow, has been very thorough. Only $1800 of the $2500 that the special committee hoped to collect for this purpose has been received

The books of the entire Library have been again examined during the summer, compared with the shelf-lists, and all accounted for. Not one book lost in a circulating library of nearly 70,000 volumes is a record very creditable to both readers and librarian.

The new room made by dividing the toilet-room has been completed and the stacks put in place. The additional shelf-room thus obtained has been very useful, but it has been necessary to move all the books in the General Library, to relieve their crowded condition without disturbing the classification; and though the new heating plant has taken the space for only about 250 volumes, to retain this space all the books may have to be rearranged again. This necessity for the continued moving of books, room after room, and gallery after gallery, in the effort to economize the little space remaining, shows the urgency for adopting in the near future some plan by which proper accommodations for our invaluable collection of books may be secured.

GEORGE C. HARLAN,
Chairman.

LIST OF PAPERS: SECTION ON OPHTHALMOLOGY.

December, 1901.

The Value of the Operation of Sphincterectomy, by Dr. Geo. C. Harlan.

A Case of Superficial Punctate Keratitis, by Dr. Wm. Campbell Posey.

A Case of Syphilitic Ulcer of the Lower Eyelid, by Dr. Wm. Campbell Posey.

Effects of Change of Color upon Pigment Bacteria, by Dr. Charles A. Oliver.

Systematic Annual Examinations of the Eyes of Children in the Public Schools, by Dr. S. D. Risley.

A Case of Cystadenoma of the Lacrymal Caruncle, by Dr. C. A. Veasey.

A Portable Magnet for the Extraction of Iron or Steel, by Dr. William M. Sweet.

January, 1902.

A Case of Congenital Orbital Cyst with Microphthalmus, by Dr. Geo. C. Harlan.

A Case of Bullet Wound of the Orbit, by Dr. C. W. LeFevre (by invitation).

Treatment of Detachment of the Retina by Means of Scleral Puncture, followed by Large Subconjunctival Injections of Salt Solution, by Dr. G. E. de Schweinitz.

Removal of a Piece of Steel from the Vitreous by the Sweet Magnet, by Dr. Wm. Thomson.

Cases of Acute Contagious Conjunctivitis Associated with the Formation of Phlyctenules at the Corneal Margin, by Dr. E. A. Shumway.

February, 1902.

Transient Monocular Blindness, by Dr. Wm. Campbell Posey.

Models for Teaching the Refraction and Movements of the Eye, by Dr. B. Alex. Randall.

Epibulbar Growth at the Corneo-scleral Junction, by Drs. G. E. de Schweinitz and William M. Sweet.

March, 1902.

A Case of Tubercle of the Iris, by Dr. Wm. Campbell Posey.

A Coquille to Aid in the Detection of Diplopia, by Dr. Wm. Campbell Posey.

The De Zeng Luminous Retinoscope, by Dr. James Thorington.

A Case of Carcinoma of the Eyelids, with Secondary Involvement of the Eyeball, by Drs. Wm. Campbell Posey and E. A. Shumway.

Bilateral Sympathectomy for Chronic Glaucoma, the Interval Between the Operations Being Six Weeks, by Dr. G. E. de Schweinitz.

Presentation of an Eye Removed for Congenital Glaucoma, by Dr. Geo. C. Harlan.

Two Cases of Glaucoma, by Dr. H. F. Hansell.

Rapid Changes in Refraction Accompanying Variations in the Amount of Sugar in the Urine, by Dr. John T. Carpenter.

April, 1902.

Exhibition of Macroscopic Eye Specimens, by Dr. Harold G. Goldberg (by invitation).

Exhibition of the Edinger Projection Apparatus, by Drs. G. E. de Schweinitz and E. A. Shumway.

Cases of Congenital Defects of the Choroid of Somewhat Unusual Form and Situation, by Dr. G. E de Schweinitz.

Illustrations of the Usual Varieties of Inferior Conus, by Dr. G. E. de Schweinitz.

A Case of Unusual Choreiform Alterations in the Width of the Palpebral Fissure, by Dr. Wm. Campbell Posey.

Primary Syphilitic Optic Neuritis, by Dr. C. A. Veasey.

October, 1902.

A Case of Multiple Rupture of the Choroid, with Transient Glaucoma, by Dr. H. F. Hansell.

A Case of Intense Phlegmon of the Orbit Secondary to Empyema of the Ethmoid, by Dr. Wm. Campbell Posey.

Spontaneous Perforation of the Cornea, by Dr. C. A. Veasey.

Some Metallic Foreign Bodies in the Interior of the Eye Localized by Sweet's Method of Radiography, and Removal with the Magnet, by Dr. G. E. de Schweinitz.

November, 1902.

A Case of Intermittent Exophthalmos, by Dr. Wm. Campbell Posey.

Two Cases of Congenital Anomalies of the Eyes, by Dr. Wm. Campbell Posey.

Disappearance of the Lesions in Circinate Retinitis, by Dr. G. E. de Schweinitz.

A series of Macroscopic Eyeballs Showing the Various Lesions after Injury, by Drs. G. E. de Schweinitz and E. A. Shumway.

Some Aids in Locating and Removing Foreign Bodies of the Cornea, by Dr. B. Alex. Randall.

A Case of Herpes Zoster Ophthalmicus with Paresis of the Oculomotor Nerve, by Dr. Wm. Zentmayer.

WILLIAM M. SWEET,
Clerk of Section.

LIST OF PAPERS: SECTION ON OTOLOGY AND LARYNGOLOGY.

December 18, 1901.

Case of Ludwig's Disease, by Dr. E. B. Gleason.

A Case of Unilateral Abductor Paralysis of the Larynx (right side), by Dr. Walter Roberts.

Scarlatinous Empyema of the Anterior-superior Squamomastoid Cells; Operation; Recovery, by Dr. C. H. Burnett.

Pathogenesis of Lacunar Keratosis of the Tonsils, with Slides, by Dr. George B. Wood.

Observations on the Practical Value of Intratracheal Medication, by Dr. P. S. Donnellan.

January 15, 1902.

Card Specimens: A Case of Double Turbinal, with Cleft Palate, etc. Loss of Bony Septum, with Preservation of Soft Tissue at its Posterior Margin. A Peaked Hook Cartilage of the Eustachian Tube Mouth, by Dr. B. Alex. Randall

Brief Report of a Case of Carcinoma of the Nose, by Dr. George C. Stout.

A Case of Ludwig's Disease, by Dr. E. B. Gleason.

Somnolence and Loss of Memory Resulting from Cholesteatoma of the Middle Ear, by Dr. F. R. Packard.

February 19, 1902.

A Critical Review of the Operations Suggested for Removal of the Lymphoid Tissue of the Faucial Tonsils, with Some General Comments and a Report of Cases of Excision, in which little or no Wounding of the Capsular Sheath and Adjacent Pharyngeal Mucous Membrane Occurred, by Dr. Robert C. Myles, of New York (by invitation).

March 19, 1902.

Case of Syphilitic Laryngitis with Pulmonary Complications, with Exhibition of Patient, by Dr. P. S. Donnellan.

The Pathology of Hyperkeratosis, Commonly Known as Pharyngomycosis, with Lantern-slide Illustrations, by Dr. D. Braden Kyle. Dr. Kyle's paper was discussed by Dr. C. W. Richardson, of Washington, D. C. (by invitation).

April 16, 1902.

A Large Reeurrent Growth in the Nasal Passages, with Exhibition of Patient, by Dr. George M. Marshall.

Exhibition of a Nasal Snare of Great Strength and Ease of Manipulation, by Dr. George M. Marshall.

A Case of Chronic Laryngitis with Marked Family History of Pulmonary Tuberculosis, with exhibition of patient, by Dr. P. S. Donnellan.

Endothelioma of the Nasal Fossa, by Dr. George B. Wood.

The Management of Chronic Suppurating Frontal Sinusitis, by Dr. J. H. Byran, of Washington (by invitation).

May 21, 1902.

Endothelioma of the Nasal Fossa, accompanied by Microscopic Slides, by Dr. George B. Wood.

A Case of Sarcoma (?) of the Ethmoid Cells, by Dr. Jos. S. Gibb.

A Further Modification of the Author's V-shaped Operation for the Correction of Deflections of the Septum, by Dr. D. Braden Kyle.

October 15, 1902.

Exostoses of the External Auditory Canal, Dr. B. Alex. Randall.

Emphysema of the Face from Fracture of the Middle Turbinate, by Dr. D. Braden Kyle.

Hæmatoma of the Auricle, by Dr. W. G. B. Harland.

Congenital Malformation of the Auricle, by Dr. Francis R. Packard.

November 19, 1902.

Ossiculectomy, by Dr. E. B. Dench, of New York.

F. R. PACKARD,
Clerk of Section.

LIST OF PAPERS: SECTION ON GENERAL MEDICINE.

DECEMBER 1, 1901, to DECEMBER 1, 1902.

Papers Read.

Demonstration of Some Peculiar Bodies Found in the Peripheral Blood of a Case of Abdominal Tumor Resembling the Parasites of Cancer described by Gaylord, by Dr. Sailer.

Skin Eruptions in Malaria, with the Report of a Case of Urticaria, by Dr. David Riesman.

A Study of the Initial Symptoms in One Hundred Recent Cases of Smallpox, by Drs. Wm. Welch and Jay F. Schamberg.

A Case of Pneumococcic Arthritis Complicating Acute Croupous Pneumonia, by Dr. D. J. Milton Miller.

A Case of Insanity of Doubt, by Dr. John H. W. Rhein.

A Case of Aortic Stenosis Ending in Sudden Death; Dilatation of the Aorta at its Root and Marked Stenosis of the Vessel Beyond, by Dr. Anders.

A Summary of the Recent Literature on Pneumonia, Bronchitis, and Asthma, by Dr. John M. Swan.

A Case of Mediastinal Tumor, by Dr. A. O. J. Kelly.

A Case of Perforative Appendicitis with Abscess—Operation and Recovery, by Dr. Hermann B. Allyn.

Spontaneous Pneumothorax, with the Report of a Case Ending in Recovery, in a Man Aged Twenty-seven Years, by Dr. David Riesman and Dr. Louis Jacobs (by invitation)

The Chemistry and Physiology of the Suprarenal Glands, by Dr. Abel, of Baltimore (by invitation).

The Pathology of the Adrenals, by Dr. Simon Flexner.

The Clinical Manifestations of the Diseases of the Adrenals, by Dr. William Osler.

The Therapeutic Uses of the Derivatives of the Adrenals, by Dr. Alfred Stengel.

The Use of the Adrenalin Preparations in Diseases of the Eye, by Dr. George E. de Schweinitz.

The Use of the Adrenalin Preparations in Diseases of the Nose and Throat, by Dr. D. Braden Kyle.

The Acarus Farinæ, an Occasional Parasite Found in Urine; Exhibition of Specimen, by Dr. Alfred Hand.

A Case of Cancer of the Stomach, by Drs. J. D. Steele and A. P. Francine (by invitation).

Spondylosis Rhizomyelique and the Relative Frequency of Spinal Involvement in Rheumatoid Arthritis, by Drs. Charles W. Burr and A. C. Buckley (by invitation).

A Case of Gliomatosis, by Dr. A. A. Eshner.

Hæmopericardium, with the Report of a Case Simulating Mediastinal Tumor, by Dr. David Riesman.

A Case of Acute Intestinal Obstruction Caused by a Large Gallstone—Operation and Death, by Dr. J. Alison Scott.

Traumatic Lesions of the Brain in Relation to Operation, by Dr. Wm. G. Spiller.

Notes of a Case of Leprosy, Dr. J. H. Musser.

A Preliminary Report of Two Cases of Pulmonary Thrombosis in Typhoid Fever, by Dr. Alfred Stengel.

Cases Shown.

A Case of Myxœdema Exhibited to the Section four years previous, by Dr. D. J. Milton Miller.

A Case of Aortic Regurgitation, by Dr. A. A. Eshner.

A Remarkable Case of Musical Heart Murmur, by Dr. H. A. Hare.

A similar case to above, of less marked degree, by Dr. Ashton.

A Case of Hysteria in a Small-sized Giant, by Dr. Burr.

A Patient Showing Some of the Signs of Aneurism of the Abdominal Aorta, by Dr. M. H. Fussell.

A Case of Arthritis, by Dr. A. A. Eshner.

A Patient with Paraplegia Following Lumbar Puncture for Cerebro-spinal Meningitis, by Drs. Spiller and McKee (by invitation).

Two Cases Illustrating the Ill Effects of Long-delayed Operation in Traumatisms of the Brain, by Dr. Wm. G. Spiller.

A Patient in Whom Dr. Weisenberg had Accidentally Discovered a New Reflex, Evidenced by Tapping on the Angle of the Jaw, by Dr. Charles K. Mills.

A Case of Osteitis Deformans in a Man, the Subject of Heart and Kidney Disease, by Dr. James C. Wilson.

A Patient Suffering from Aeromegaly, by Dr. A. A. Eshner.

Pathological Specimens.

A Specimen of Gastric Ulcer, by Dr. Ashhurst (for Dr. D. J. M. Miller).

Wright's Coagulation Tubes (pathological instrument), by Dr. W. T. Longcope (by invitation).

Specimen of Acarus Farinæ, by Dr. Alfred Hand, Jr.

The Heart from a Case of Aortic Regurgitation with Musical Murmur, by Dr. F. A. Packard.

A Gallstone Weighing 8.35 Grammes, by Dr. Addinell Hewson.

SAMUEL McC. HAMILL,
Clerk of Section.

LIST OF PAPERS: SECTION ON GYNECOLOGY.

December 19, 1901.

Retroversion and Retroflexion of the Uterus, by Dr. Edward P. Davis.

Primary Carcinoma of the Uterine Fundus, by Dr. J. M. Baldy.

The Technique of Amputation of the Cervix, by Dr. Charles P. Noble.

January 16, 1902.

Report of Cases. (*a*) Vesicovaginal Fistula. (*b*) Extra-uterine Pregnancy. (*c*) Post-puerperal Pelvic Abscess, death from intestinal hemorrhage, by Dr. George Erety Shoemaker.

Report of a Case of Intraligamentary Glandular Ovarian Cyst, by Dr. R. P. McReynolds.

Phlebolith Simulating Uterine Stone, by Dr. John G. Clark.

February 20, 1902.

Complete Prolapse in Nulliparous Women, by Dr. H. D. Beyea.

A New Operation for Retrodisplacement, by Dr. J. M. Baldy.

Pessary and Stones Removed from Female Bladder, by Dr. J. M. Baldy.

Two Hysterectomies for Fibroid Tumor with Marked Anemia, by Dr. J. H. Girvin.

March 20, 1902.

A New Operation for Cystocele, by Dr. B. C. Hirst.

The Etiology of Extra-uterine Pregnancy, by Dr. B. M. Anspach (by invitation).

Uterus Bicornis with Double Vagina, by Dr. John H. Girvin.

April 17, 1902.

Report of Cases. (*a*) Two Cases of Deciduoma Malignum. (*b*) Case of Epithelioma of the Clitoris, by Dr. Charles P. Noble.

A Case of Elephantiasis of the Vulva, by Dr. R. P. McReynolds.

Appendicitis by Continuity, by Dr. George Erety Shoemaker.

A Brief History of a Case of Diecphalus Monster, with Presentation of the Specimen, by Dr. George M. Boyd.

October 16, 1902.

Diastasis of the Abdominal Muscles, by Dr. R. P. McReynolds.
Specimen of Myoma of the Ovary, by Dr. J. M. Baldy.

November 20, 1902.

Pathological Lesions of Gonorrhœa, by Dr. John G. Clark.
The Treatment of Gonorrhœa in Women, by Dr. William A. Small (by invitation).
Pregnancy Complicated by Heart Disease, by Dr. William R. Nicholson.

JOHN H. GIRVIN,
Clerk of Section.

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